The Foundry Trade Journal

AND

PATTERN-MAKER.

THE OFFICIAL ORGAN OF THE BRITISH FOUNDRYMEN'S ASSOCIATION.

Vol. 9. NOVEMBER, 1907. No. 71.

—PUBLISHED—

THE FIRST WEEK IN EACH MONTH BY

EAGLAND & Co., Ltd.,

165, STRAND, LONDON, W.C.

Devoted to the interests and advancement of the Iron, Steel and Brass Foundry Trades.

Subscription Terms: 7s. 6d. per annum. post free.

To place the "Journal" within the reach of Working Moulders and Pattern-makers the Proprietors will accept subscriptions, not less than three in number from one shop, at the reduced rate of 5/- per annum, such order to be countersigned by the superintendent or foreman of the shop as a guarantee of good faith.

Any Subscriber having difficulty in obtaining copies promptly should notify the Publisher of the "Foundry Trade Journal," 165, Strand, London, W.C., giving the name of his local newsagent.

WE INVITE PRACTICAL ARTICLES ON THE TRADE IN ALL ITS BRANCHES WHICH WILL BE PAID FOR. MSS. SHOULD BE WRITTEN ON ONE SIDE OF THE PAPER ONLY.

All communications to be addressed to the Editor, or to the Publisher, as the case may be, of

THE FOUNDRY TRADE JOURNAL,
165, Strand, London, W.C.

BRITISH FOUNDRYMEN'S ASSOCIATION.
LIST OF SECRETARIES.

General Secretary: J. E. H. Allbutt, Sheepbridge House, Chesterfield.
Manchester: C. Carson Bransby, 113, School Road, Stretford.
Birmingham: C. Heggie, 76, Hillaries Road, Erdington, near Birmingham.
Cardiff: R. Griffiths, Messrs. J. Williams & Sons, Ltd., Globe Foundry, Cardiff.

CONTRACTION AND COOLING OF CAST-IRON.

By C. E. Allen.

On this subject it is known that the contraction under equal reductions of temperature is different in iron of different qualities. Soft grey iron, which contains a high proportion of carbon, contracts least, and that which founders term high, which is hard, light, and close-grained and contains the least percentage of carbon, contracts most, other circumstances being equal. The contraction of the same iron is greater or less according to the greater or less rapidity with which it is cooled. That which is cooled most rapidly contracts most. The utmost care and attention are required on the part of the engineer and ironfounder to regulate the cooling and contraction of metals. In the province of the former, it is of primary importance that the design and arrangement of the parts of castings should be such as to ensure, as far as possible, uniformity in the shrinkage, so that there should be equal tension in all the parts. Nothing is so dangerous in cast-iron constructions as the unequal tension arising from contraction, and in cases where castings, either from necessity or otherwise, have their parts varied in thickness or position, it requires consideration on the part of the ironfounder to retain the fluidity of the thinner parts as long as possible, and to accelerate, with proper precautions, the cooling of the parts which contain increased quantities of metal. In the very centre of castings a principle of insecurity and danger exists which not infrequently tears the parts asunder with a loud report. Careful consideration in the caster will, in most cases, obviate this evil. Articles which contain a large mass of metal cool from the exterior, a thin external crust being first formed, then on the interior of this a second, and so on, towards the centre. Suppose that just as all the liquid iron

has become solid the exterior has cooled down to the temperature of the atmosphere, there would be a difference of temperature of 2,700 degrees between the exterior and the interior. At this time it would be entirely free and unstrained by contraction, but as the exterior of the casting has cooled down to a temperature at which contraction has ceased, and the interior remains at the melting point, 2,700 degrees higher, the contraction due to the latter ($\frac{1}{8}$th part of its linear dimensions) is yet to occur in the centre after the exterior has ceased to contract. The effect of such a contraction must be to exert a strain of compression on the exterior and one of elongation on the interior. The above supposes an extreme case, in which a maximum of difference of temperature between the exterior and interior occurs—a condition which never occurs in practice. But it serves, nevertheless, to explain the law which governs the contraction of iron, and what is believed to be its injurious effect in castings which are unequally cooled. If another strain be opposed to that produced by unequal contraction, take for example a cast-iron beam with a thick flange on the lower side and a thin one on the upper, the tendency would be for the thin side to solidify some time before the other had cooled down to that point. In the act of cooling, the contraction of the metal of the thin flange would tend to give it a concave form, but afterwards the larger mass of metal in the thick flange, passing from the fluid to the solid state, and contracting still more forcibly, would force the upper flange into a convex form and ensure a considerable tension in the upper flange by bending the beam upwards and forming a concavity on the under side. A beam or casting of any kind, therefore, having one side in a state of tension and the other in a state of compression, with its cohesive powers below uninjured, is precisely in the most favourable condition for sustaining a load. It is evident that in submitting a beam of this kind to strain by suspending a weight from the middle, its bearing powers are improved rather than diminished. By increasing the weight till the deflection of the beam relieves the tension on the upper flange, by forcing the particles together and throwing a tensile strain on the lower flange, the beam is in the same condition for supporting a load as if no strains had been produced by contraction in cooling. In the case of cannon cast solid, the strains produced by contraction acting in the opposite direction to those spoken of, tend to burst the gun and weaken it, by acting in the same direction as the strain produced by firing. Viewing the subject in this light, it will be found that the power of resistance to strain is constant when the load remains uniform and undisturbed. Thus, if the beam were loaded to within 1,100th part of its breaking weight, it would continue to support the load *ad infinitum* if it remained undisturbed and without change. In this condition the whole of its powers of resistance are brought to bear upon the load.

In all constructions it is essential that the greatest care should be taken in casting to have the metal perfectly liquid and of the right temperature, to give time in cooling, and to assist the natural process of crystallisation, so as to allow the crystals to form regularly, in order to ensure uniformity of tension in all the parts.

——o——

SELLING FOR THE FOUNDRY.*

WHILE much has been written recently on the importance of finding the cost of work produced in the foundry, the absolute necessity of knowing the approximate cost of castings before bidding on the work has not been sufficiently dwelt upon. It is too much the custom of foundrymen to glance at a bunch of blue prints, and if they appear similar to work which has been done before, the price is made the same as was obtained for the other work, and too often when it is put in the foundry unexpected difficulties appear which add much to the cost; while it is often difficult to have a careful estimate made in advance by reason of lack of time or insufficient data. If a foundryman absolutely refuses to quote until he has made an estimate he will find in nearly every case his customer will allow him sufficient time to make figures, and that profits at the end of the year will be much increased.

Estimates must be Correct.

To sell satisfactorily a foundryman must know that his estimates are correct, for this will give him a confidence in the price at which he is offering his castings that

* Paper read by E. A. Kebler before the Pittsburgh Foundrymen's Association, September 8th, 1907.

cannot be obtained in any other way; in fact, an estimate which is not afterwards verified by the actual cost is of but little value. As an instance of this, a foundry which based its quotation on an estimate sheet compiled by its superintendent in consultation with his foreman, adopted one on which the detailed actual cost was also entered after the work was completed, so that at a glance the correctness of each item in the estimate could be seen. When this new form was first used the estimates were found to have been very unreliable, but after the differences between the cost and estimates had been rigorously pointed out, the superintendent and his assistants were educated by this so that they could correctly estimate. To show the value of this, an estimate for 300 castings was made, showing that a moulder and a helper would make one casting in two days; knowing that this must also be shown by the actual cost, the length of time taken in making the first few was figured up, and it was found that, instead of two days, a casting required three days' labour. Knowing they would be censured for the error in their estimate, the foundry people by changing their tools were able to bring their cost below their estimate, which certainly would not have been the case if the check on the estimate was not being made.

A very serious mistake is made by some foundrymen who base their quotations on the prices named by others. A mill whose castings, while apparently similar to those of other plants, were really much more expensive to make, "worked" the foundries beautifully, getting its repairs for the first year at less than cost, and continued doing so by placing its orders for succeeding years with different foundries at approximately the same price by showing the bidders the figures which had been paid in preceding years. Unless a foundry knows by actual experience or can figure the costs of the repair required during, say, the last few months, it is very dangerous to take an indefinite order like the above unless a large margin of profit is allowed. These yearly repair contracts are also unsatisfactory for this reason; if prices of castings advance the mill may stock up repair parts, while on a falling market the repairs are often inconsiderable.

As the profits vary on different classes of castings, a foundry salesman should keep constantly before him the desirability of securing orders which will yield the most profit, as his value to the company largely depends on this. One foundry keeps a careful record of this, so that a salesman who on a smaller tonnage obtains more returns is appreciated more than a man who fills up the shop on orders which show but little profit. If this is carefully followed up, it is found that the foundry gradually replaces the manufacture of castings which give but little profit and runs its shop on the more profitable work.

Securing New Kinds of Work.

Too often foundrymen are not alert to secure orders for work which they had not previously made, or for which their castings might be used. A foundry salesman, overhearing the manager of a company telling his purchasing agent that some steel work which they were using was rusting out, suggested the substitution of cast iron, and thus secured large orders from this plant and others for a class of work which heretofore had never been made in a foundry.

A decided change has taken place in the selling of material, and now to be a good foundry salesman a man must not only be a good talker, but must be thoroughly conversant with the class of castings he is selling, and often must know how they should be used to get the best results. As the buyer often relies on the representations of the seller, it is absolutely essential that the latter be honest in his statements if he wishes to hold his trade. A first order often hinges on this very consideration. Recently a buyer was in the market for some material, and clearly showed the bidders that he wished the material to have a certain peculiar characteristic. He placed his sample order not with those who flatly stated that their material would be as specified, for the buyer knew that the requirement was an unknown one, but with the salesman who frankly told him that he could not promise to fill the bill, but would sell him subject to a sample which could be tested.

The modern salesman must also know what can be used successfully under varying conditions, for if he should supply a casting, no matter how good, which could not be used to advantage in the customer's work, a return order need not be expected. He must also keep in touch with the requirements of his customers, for by so doing he may be able to convince them that it is to their advantage to purchase material which under ordinary conditions would be made in their own works. For instance, a seller was able to dispose of a round block of material because he had learned, even before its president, that owing to an accident a company's production of this raw material had been cut off.

JUDGING COKE FROM ITS APPEARANCE.

—o—

By A. Thau, Clay Cross.

(*Continued from page* 437.)

It would, however, be a mistake to refuse at once all coke looking black and uncomely. For example, Fig. 6 shows the coke of the great iron works (600 ovens) at Cape Breton, Canada, which is very dense owing to its metallic admixture, but holds the quenching water on the surface, and therefore always looks black. Its fracture shows faint peculiar gloss, and from its unusually high density a large percentage of ash may at once be anticipated. Nevertheless, its metallurgical working is excellent. Its analysis proved 38.48 per cent. ash; 1.612 per cent. sulphur; and 1.1 per cent. volatile matters. But the metallic percentage of coke is not always shown by dark colour; and with metallic coke the colour is the brighter the more porous the coke is. Fig. 7 represents a piece of coke from Japan. The pieces were very short, proving the ovens to be very narrow; it is exceedingly firm, and crossed by many fine cracks. The coal was not washed, but the surface shows no impurities; here also the great percentage of ash can be deduced from the strikingly heavy density.

Fig. 6.—Metallic Coke from Unwashed Coal, produced in Canada.

Analysis.—38.48 per cent. ash; 1.612 per cent. sulphur; 1.1 per cent. volatile matters.

Fig. 8 shows, though incompletely, a kind of coke occurring more seldom. It is rather dense, without any sound, and mostly grey-black without gloss; but many silver-grey glossy spots of the size of a stamp are found in it. Such coke is generally rejected, being rotten and crumbly. Its origin can be referred to a bad mixture of good coke coal with meagre or decomposed stock coal, or to the fact that the coal catches fire in the coal receptacle, or reaches a temperature near conflagration.

The Saar coke is mostly very porous, which may account for the first experiments in compressing coke coal having been made in the Saar district. Fig. 9 shows a piece of uncompressed Saar coke, very firm in spite of its porosity, and appreciated as useful blast furnace coke. Much more striking are the pores in the coke in Fig. 10, produced in America, near Chicago. Here the pores are more unsatisfactory than with Saar coke. The large pores may be accounted for by very wet coal, having on an average not below 17 per cent. of water, being put into very hot ovens. The coke has not the firmness required for the blast furnace. Compressing plants are now being built, to try and obtain this firmness. This will no doubt be arrived at if the swelling of the coal does not offer any difficulty. A specimen of swelling coke uncompressed is shown in Fig. 11. The piece was taken from the Silesian manufacturing district. Swelling coke is recognised by the part of the coke which was adjacent to the side walls being most porous; towards the centre it gradually grows denser. Great trouble often arises when this coke is discharged, especially if parts of the coke cake are not sufficiently burnt. When this coal was charged compressed, it swelled so that it broke the walls of the oven. The next step was to make the coal cake or the compressing box considerably smaller than the oven. The results thus obtained have not become known, so far as I know.

While in the cases referred to the compressing plants serve only to improve the coke, there is also produced from many mines coal which when uncompressed does not form an adherent coke, so that it entirely depends on the stamper. An instance of this is a piece of French coke

FIG. 7.—JAPANESE COKE FROM UNWASHED COAL.

Analysis.—32.4 per cent. ash; 0.612 per cent. sulphur; 0.07 per cent. volatile matters.

FIG. 8.—COKE FROM BADLY MIXED OR DECOMPOSED COMPRESSED COAL.

Analysis.—9.12 per cent. ash; 1.312 per cent. sulphur; 2.11 per cent. volatile matters.

FIG. 9.—SAAR COKE, UNCOMPRESSED.

Analysis.—10.2 per cent. ash; 1.03 per cent. sulphur; 0.9 per cent. volatile matters.

FIG. 10.—AMERICAN COKE, TOO POROUS; UNCOMPRESSED.

Analysis.—9.6 per cent. ash; 1.861 per cent. sulphur; 0.99 per cent. volatile matters.

FIG. 11.—SILESIAN COKE, SWELLING.

Analysis.—9.13 per cent. ash; 1.66 per cent. sulphur; 1.0. per cent. volatile matters.

FIG. 12.—FRENCH COKE, ADHERENT ONLY WHEN COMPRESSED.

Analysis.—11.08 per cent. ash; 2.24 per cent. sulphur; 1.11 per cent. volatile matters.

FIG. 13.—COKE FROM MORAVIAN OSTRAU; IMPURE BY REASON OF SMALL PIECES OF BITUMINOUS SLATE.

Analysis.—18.23 per cent. ash; 2.714 per cent. sulphur; 1.06 per cent. volatile matters.

FIG. 14.—COKE FROM UNWASHED COAL, UNFIT FOR USE.

Analysis.—40.0 per cent. ash; 3.16 per cent. sulphur; 0.96 per cent. volatile matters.

in Fig. 12. This coke is beautifully dense, but has many cracks, and therefore easily falls to small pieces. Not only for this reason, but especially on account of its large percentage of sulphur, it is not fit for blast furnace and foundry.

To judge the coke as to its percentage of ash, a fragment should be viewed through an ordinary magnifying glass. If small pieces of bituminous slate are found, as shown in Fig. 13 by a piece from Moravian-Ostrau, it can safely be concluded that the percentage of ash exceeds 10 per cent. Usually one is tempted to assume a high percentage of sulphur in such coke, which, in fact, generally is correct; but there are many exceptions. If the coke is as impure as shown in Fig. 14 it is useless. This coke originated when an attempt was made—the machine for washing the coal being broken—to continue producing coke from unwashed coal.

Recapitulating the results of the examinations, we find in all kinds of coke the following characteristics of a high percentage of ash:—(1) Impurities from incombustible substances in the fragment; (2) dark sandy appearance without much porosity; (3) remarkably high density; (4) the rims of the pores in the fragment are of a metallic gloss.

A high percentage of volatile matters is shown by:—(1) Noiseless fall on a firm object; (2) black, glossless appearance; (3) small blue-black spots in the fragment caused by uncoked coal; (4) thick pieces, not of stalk shape, and easily crumbling; (5) deep black interior of the pores and tar gloss of the edges.

A high percentage of water is easily ascertained when a little piece of coke is taken off, and the pores filled with water are seen under the magnifying glass. One can also clasp with the hand an oblong piece of coke; if the coke is damp; it will be cold to the touch. Six per cent. of water, however, is so absorbed by the pores that we can hardly, if at all, perceive it.

Finally, it may be stated that the specimens were taken just as they were available, but coke from different manufacturing districts was used to furnish illustrations. It is not suggested, however, that just the sort in question prevails there.

As already mentioned, the appearance of the coke offers no indication as to its percentage of sulphur.

——o——

THE STAHLWERKS-VERBAND'S BRITISH AGENCY have removed to Norfolk House, 7, Laurence Pountney Hill, E.C.

BENDING CAST IRON.

WE wish in the present article to make some observations on a comparatively new feature in foundry practice, a description of which may be of general interest to foundrymen. The idea to which we wish to draw attention refers to the bending of cast iron while hot, a physical property in cast iron with which some foundrymen

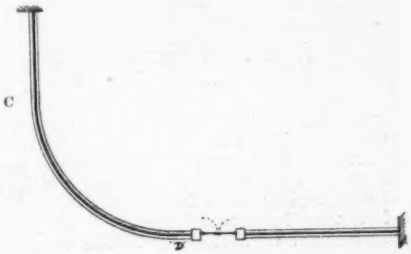


FIG. 1

are more or less acquainted, according to the particular class of work in which they may be engaged. Every foundryman knows the difficulty which exists in certain classes of work of getting it to turn out perfectly straight.

The effect which contraction has on the metal is one, and the unequal ramming of the mould is another of the causes which create bent castings.

The first of these, however, is by far the greatest factor with which the moulder has to contend, and although certain provisions may be embodied in the pattern to counteract the effect of contraction, bent castings will from time to time turn up, necessitating the work being taken to the

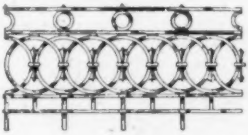


FIG. 2

fire, heated and brought back to the shape it should have taken when it first left the mould.

In certain specifications castings, should they turn out bent, will not be allowed to be straightened, as the process creates a weakness in the casting.

With other castings, however, the ques-

tion of strength is not involved, and it is with the latter that we are at present immediately concerned, and wish to make some observations thereon.

The foundryman having found from experience that it was possible to straighten a bent casting, naturally concluded that he might, if it were necessary, bend a straight casting.

He having verified his deductions, has now introduced quite a new feature into that branch of foundry work which is

FIG. 3

associated with ornamental castings. Castings which formerly could not be produced without considerable expense can now be turned out at a mere nominal figure, and the time for production, which is a very important factor in some jobs, is reduced to a minimum. The class of

FIG. 4

work to which we wish especially to refer is that of cast iron railing. Most frequently with this class of work orders come to hand for stretches of railing to suit positions which are circular, or partly circular, and partly straight.

Fig. 1 is a plan showing a typical illustration of what is often required, the part lying between C and D being circular,

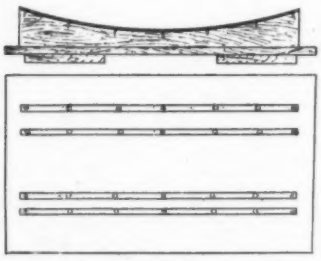


FIG 5

and it will be to this part that our remarks will be chiefly directed.

When preparing patterns for a circular railing the practice hitherto has been first to make a straight pattern, and from this cast a pattern in lead and bend it to the required curve.

A little difficulty is involved by this method, in so far that in casting the lead pattern a certain amount of shrinkage has taken place, necessitating the cutting of the lead in various places and widening it out to the exact size of the pattern from which it was cast. This is necessary in order that a casting from each will be exactly similar in every respect when they are brought together, so that the continuity of the design will be maintained throughout. It might be well to state here that for this class of work the castings are made in lengths of from 3 ft. to 4 ft. long to facilitate in casting (see Fig. 2), and when joined together form one continuous stretch.

In addition to this cutting and soldering of the lead pattern, a certain amount

FIG 6

of time is taken up in filing the lead, for lead, like other metals, has a rough skin when cast, and requires to be filed up like an ordinary iron or brass pattern to allow it to be easily withdrawn from the mould.

After this filing up process a wooden block is prepared to the required curve, and on this the lead pattern is laid and bent into form, and from this the curved castings are made.

Fig. 3 shows the block with the pattern in position ready for the moulder.

The process which has superseded the method that has just been described

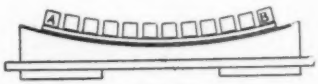


FIG. 7

brings us to the point we wish specially to consider.

With this process, which we will now discuss, the making of the second pattern is entirely done away with, and when the order is for a stock design, for which there is an existing pattern, there is practically no pattern expense beyond the cutting of one or two strips of wood hollowed out to the required curve, as shown in Fig. 4.

These strips are made about $\frac{3}{4}$ in. to 1 in. in thickness, and on to the hollowed edge is screwed a thin piece of hoop-iron,

the width of which is equal to the thickness of the wooden strips.

The use of this hoop-iron is to protect the face of the wood from burning away when in contact with the red-hot iron, as will be shown later. These hollowed strips of wood are secured to a "laying down" board, as shown in Fig. 5.

The number of strips required depends on the width of the casting to be treated. In the illustration Fig. 5, four are shown, thus allowing one strip below each of the horizontal rails in the design, Fig. 2.

Weights are next required. In some shops ordinary bars of pig-iron are used, but it is preferable to have these weights specially made with a straight face so that they will bear equally along the entire length of the work being treated.

These weights should be about 3 in. square and about 3 ft. long.

It is hardly necessary to state that these weights, when once made, serve for all occasions.

The next thing to be done is to make a casting just in the ordinary way from the straight pattern, and immediately the metal has set the casting is removed from the mould while it is red-hot and placed on the top of the hollowed strips, as shown in Fig. 6. The weights are now applied, one being placed at A and another at B, shown by dotted line on Fig. 6. When these weights are put in position the casting will commence to show signs of sagging.

At this point other two weights are applied, one placed beside A, and the other beside B. This process is continued until the panel has been completely bent to the shape of the curved strips.

Fig. 7 shows the railing in its finished state with all the weights in position. The weights are allowed to lie on the casting until it has cooled, and when they are removed the casting will be exactly the shape of the curved strips, and being made from the same pattern as those for the straight part of the work, these will join each other without any trouble.

Care must be taken when applying the weights to commence at the ends and work towards the centre. It is surprising how quickly the metal takes the curve, and seldom does a casting break in the process.

It will be observed from the foregoing that a considerable saving in time, labour, and material is effected, and the idea, although applied to a special class of work, may with advantage be applied to other kinds of work at the discretion of the foundryman.

ENGINEERING BRASS FOUNDRY.

By J. Clements.

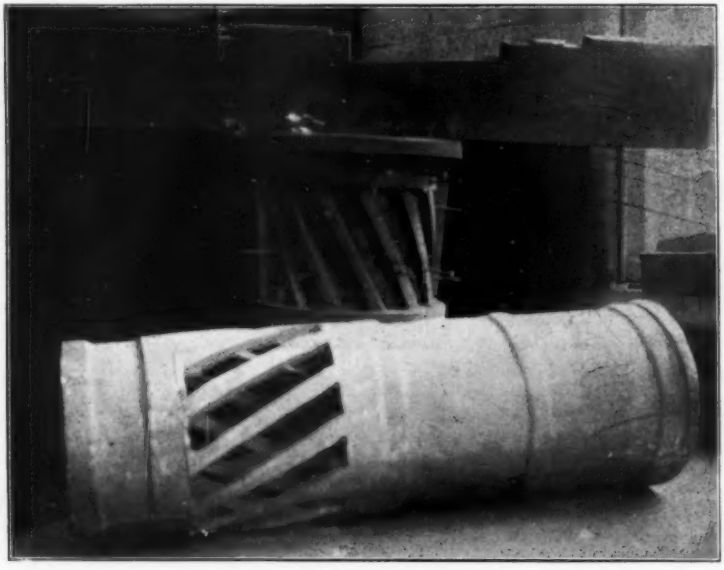
After reading the discussions at the meetings of the British Foundrymen's Association, I am almost debating in my own mind as to my right in speaking of "Brassfoundry." Iron and steel founding, certainly seemed to take all the honours, but with the Editor's permission I will run the risk, and resume my talk on brassfounding The subject of my present article is a job that was new to the shop, though it is almost a daily occurrence to make many of a similar species of casting, viz., a condensor liner. In illustrating this article I have only one regret, and that is that my first illustration missed fire owing to the vagaries of my camera.

The liner in question had to be made from a core pattern struck up in loam, with the aid of the usual strickle board, seen in the illustration. These two cores had also to be made, out of the core-box shown also in illustration underneath the board. The projecting nails will no doubt be readily understood by the practical moulder as being there simply to hold the loose pieces in place during the making up of these cores, these nails being withdrawn immediately there is a sufficiency of sand rammed in to keep the loose pieces in their places. Wires are required to follow out this half-circle, connected by others in a transverse direction, much resembling the outside of a birdcage. In making this core up, fair-sized sprigs may be used with advantage, and in the parts resembling a grid or bars, these will strengthen the core materially and prevent it being broken away. These cores having been made up and dried, should be blacked in parts where the work comes. Then the main core should be struck up, first as a pattern, of course. If the strickle board be examined for one moment and at the same time the internal diameter of liner, 12 in., and the general contour of the pattern when struck up, the necessity of this can at once be understood. At one part of the pattern the diameter is something like 18 in.; this is the largest end of the print. For the loose half-cores described above and made from the sectional core-box shown in the casting of liner illustration, these half-sections taper down to about 13 in. or so.

Then, everything having been prepared in the shape of cores and the core

pattern struck up and ready for use, the moulding operation comes, the box required for this measuring 5 ft. 6 in. by 2 ft. by 2 ft. The drag side can be rammed up loosely so as to allow for the bedding of our pattern half-way into this and then finished ready for the cope, a little extra precaution being necessary owing to the pattern in this case not being of the usual material to stand the bumps it generally comes in for.

With the cope side of box well daubed inside with clay wash, or as it is often termed, "slurry," we now commence the second part of our process by ramming



up the cope, and in order to carry out the work satisfactorily we shall require at least 30 or 40 gaggers or lifters. These should be placed in position, all round the pattern, when sufficient facing and ordinary sand has been sifted over, to leave a fair amount of sand round. The pattern, gaggers, or lifters, of the L shape need only be used, and it will not be necessary for them to extend or overlap the top of the box or cope.

With these and the runner sticks placed in position, the work can be proceeded with. Here I may say that the liner is run from each end and raised from three places on the top, at each end, and in the centre. When the top of the pattern is reached the sticks for the risers can be put in place, though the casting being of a fairly uniform thickness, the risers in this case are more properly speaking floers for the freeing of the metal of all gases that may be generated in casting. Now presuming the mould to have been properly rammed up, the runner sticks, etc., withdrawn, and the cope lifted off, the nature of lift obtained can then be seen, and no doubt the mould will want a fair amount of finishing.

As the pattern struck-up is still left in the drag side, it will in this case be best to leave it there for a little while, as the finishing of the cope is a matter of considerable time, and if the pattern be withdrawn from the drag side, this would be be getting dry whilst time was being spent on the cope. The cope being finished in due course and the pattern withdrawn from the drag side, it can be taken away and finished to the size required, and in the meantime the drag side can be completed with the tools.

It will be found to be a wise proceeding now to try the cope upon the other side. Any inequalities of the two surfaces can then be seen; moreover, being in green sand, they are not likely to crumble.

Then the half-cores that form the bars or grid must be put in their respective places, the one first in the drag side, and then the body or main core, which has meanwhile been taken to its proper size, blacked and dried, should be put in place, and the corresponding half of the grid core placed over main core upon the other half-core, and put in its proper position. Again, at this juncture the cope or top side should be carefully lowered on to its fellow. These precautions are absolutely necessary for good work, and if carried out properly should ensure success.

Nothing more remains but to finish the mould throughout. If it is decided to dry it, it can be set straight away in the stove, but if made up in green sand fairly dry, this process might be dispensed with, and with the closing of the mould any pouring bushes added, then all being ready for the metal—in this case about 400 lbs. being required, cast from two crucibles, the liner, as I before mentioned, being run from each end and opposite sides—the resulting casting should be a success, and finally taken from the sand and fettled ready for finishing.

——o——

THE EARLY HISTORY OF IRON FOUNDING.

By J. Buchanan.

(*Continued from page* 485.)

Malleable Cast Iron.

This is an important industry in South Staffordshire, and is worthy of notice. In 1722, Reaumur, a Frenchman, published the fact that the heating of cast-iron castings embedded in red oxide of iron softened the metal perfectly and took away its brittle character. In 1804, Samuel Lucas got a patent for doing what appears to be the same thing that Reaumur did 82 years before. Lucas recommended the cementation of the castings in a steel converter, or other suitable furnace, during five or six days and nights, with "ironstone ore, or some of the metallic oxides, lime, or any combination of these."

The castings were packed in cylindrical cast-iron pots, and each casting was surrounded with iron ore or hammer scale. There were difficulties; probably the kind of pig-iron necessary was not clearly understood, and the patent remained unworked for some time. Latterly Thomas Lucas, of Chesterfield, brother of the patentee, overcame the difficulties, and began casting cutlery, calling it "run steel." The pig-iron he used was white Cumberland hematite. The method of making malleable castings described and patented by Lucas in 1810 is exactly the method employed in South Staffordshire to-day. There have been only two modifications of any importance. One is the use of the cupola for melting the iron instead of melting it in crucibles, though the latter method is still very largely employed. The other modification is the employment of gas instead of coal for annealing the castings. The high quality of the malleable castings made in South Staffordshire is known all over the world, and recently an American expert said of some malleable castings made in this district that neither in America nor elsewhere in England had he met with any of such high quality and finish. Notwithstanding that gratifying testimony to the excellence of the products, there is undoubtedly great occasion for the employment of scientific knowledge, and scientific accessories. The malleable castings trade has suffered much from the attitude adopted by most of those engaged in it, that it is, as it were, a secret process. There are, of course, refinements of operation known to, and naturally kept secret by, the individuals concerned, but that is true of most industries and most individuals. When people put on superior airs of how much they could say if they only cared to speak, one is apt to conclude that such reticence is quite as often a cloak for ignorance as a hiding of superior knowledge. This industry will truly advance when those practising it come out into the open and tell us of their failures. I am content that they should keep their successes to themselves. Judging the heat of the annealing oven to the human eye, skilled though it be, is subject to too many causes of inaccuracy of vision to be reliable. Some annealers aid their judgment by placing balls of sand in positions where they may be reached and withdrawn, if they have "fritted," or fused enough to stand withdrawal. That leads up to the question of why scientific accessories are not more used. The use of Seeger cones as guides to the temperatures employed would be of enormous benefit, but better still would be the recording pyrometer. The latter would give accurate details of all the course of annealing, and what is most important, would get rid of the personal equation so far as the annealer is concerned.

The Foundry Apprentice.

It will readily be granted that a continuous supply of young skilled foundrymen, able to take the places of those passing out of the business by death or other causes, is of enormous importance. It is to the foundries engaged in engineering work or to "jobbing" foundries we must look for our supply of skilled men. Foundries engaged in repetition work produce workmen able and skilled, but with a restricted outlook and experience. In America they have a four years' apprenticeship, and even then there is a distinct shortage in the supply. One result is that some of the technical colleges give courses of training in foundry work, and several of the proprietors of large foundries are following the example. I am old-fashioned enough to believe that the seven years' apprenticeship common to foundries in this country is not a day too long. To that is due the fact that to-day, as for many years past in Great Britain, we have the finest and most skilled foundry workers in the world. Technical schools and colleges have a great message for the foundry worker, and especially for the foundry foreman or manager, but for a training in practical work they are inadequate. As a substitute for apprenticeship they may be necessary, but happily we are not yet faced by that difficulty. It should be realised by all proprietors of foundries, and those having authority in foundries, that the proper training of the apprentice is a measure of the highest economy, and an important step in self-preservation. If we in our works add technical instruction to the practical experience of our apprentices, that is good; but do not let us wait until apprenticeship is dying out, and thus be forced into looking for substitutive methods which will almost certainly be inadequate.

Foundry Architecture and Equipment.

In this country it is almost invariably the case that foundries are designed by people who know nothing of foundry work, and are so self-satisfied as to be able to do without the help of those who do know. The result in many cases is what may be mildly described as a miserable failure. So it often is with the equipment of the foundry in respect of the various machines and tools to be employed. An instance of this came under my notice recently. In the particular foundry they were using expensive moulding machines, and getting results which were less favourable than others were securing without machines. On inquiry it was ascertained that these moulding machines were installed by an official who had been talked into buying them, but knew nothing whatever about moulding machines of his own knowledge. Whether moulding machines may advantageously be introduced into a particular foundry is oftentimes not easily answered even by the expert foundryman. In the higher and most skilled lines of foundry work the moulding machine is practically out of court, and even in some of the simpler forms of castings it no more than holds its own. A railway chair, for instance, is a simple form of casting, but the moulding machine has yet to be made which will beat the results obtained by hand methods. This only shows that not everyone who has power to introduce moulding machines is also a good judge of whether they should be introduced or no. There is undoubtedly a large and useful field for the moulding machine, especially the simpler forms of these. Oftimes, it has to be admitted, the success or failure of the machine depends upon the man at the machine. When they fail to do what is expected of them it has first to be considered whether they have failed for reasons pertinent to the machine, or for reasons pertinent to the man working it. When they prove a success, it is not difficult to find claimants to the honour. I have been asked if I could account for the less output obtained in this country from moulding machines compared with that claimed to be obtained in America. My reply is that the home worker can't be, and won't be, driven like the Pole or Hungarian. However Radical or Socialistic in politics our workmen may be, they are strong Conservatives in trade matters. The workman is no more to be blamed for this than another is for being Conservative in politics. Each fears that change will leave him in worse case than he was before.

Changes of method of work can only be wholly successful when it allows the workman, as well as the capitalist, to better his position. Wide and sustained recognition of this fact is the only way to get the whole-hearted co-operation of workmen when changes of method of work become necessary.

The Commercial Side of Foundry Work.

Only in the most highly organised businesses is the commercial side fully

developed. The highest practical skill may be exercised in a business and yet have results of the most disappointing character, often ending in the Bankruptcy Courts. This is due to the absence, on the part of the people conducting the business, of sufficient commercial aptitude or training. This is truest of the smaller business concerns, the practical and commercial management being often in the same hands, the practical side being much the stronger. In such cases there is almost no grasp of the immense importance of taking into account the "Standing Charges" and the less obvious outlays. Often they have no idea what their "Standing Charges" are. When estimating they take the cost of the metal and of moulding, and add a certain percentage which they believe will leave them a profit. Of that they are not certain, as they have no data to guide them as to whether it will or no. Having heard that Messrs. So-and-So are offering to supply at a certain price (which may, or may not, be true), and being certain they can work cheaper than Messrs. So-and-So, they quote a lower price than the one they have heard mentioned. Messrs. So-and-So may be on the high road to ruin, and their competitors kindly accompany them part of, if not the whole of, the way. Businesses may possibly be carried on successfully without any profound technical knowledge, but sound commercial knowledge there must be. There is now available, for use by founders, a considerable amount of data, and methods of costing which will give near approximations to the true cost of castings.

In his recent presidential address to the members of the British Foundrymen's Association, Mr. Herbert Pilkington, a past president of this Institute, rightly called attention to the enormous importance of this subject. Did this matter of commercial training receive due recognition we would meet with fewer instances of insane competition and disastrous climaxes.

Progress of the Industry.

With every advance in engineering the foundry has had to advance also; were it not so, many improvements in engineering practice would have been stifled at their birth. We are now at a transition period for many foundries. The plants which for a great number of years have been engaged in casting parts for reciprocating engines have had to tackle the problems and difficulties of the steam turbine. That they have successfully solved the problems and overcome the difficulties, the turbines of enormous power recently made for marine propulsion prove. I have no expectation that the practical foundryman of to-day, and of by-gone days, is likely to be surpassed in the future. What I hope to see is a higher type of foremen and managers. Even now there are men of the highest accomplishments in these positions, but generally in their several positions they are much inferior to the men they control. The idea is that they should equal the best of their men in practical skill, steadiness, and solidity of character, and surpass them in technical knowledge. I am glad to give expression to a firm belief that this condition of matters is being recognised, and that there is now apparent a sense of shortcomings in the direction indicated, and a desire to rise to a higher knowledge of the founder's art.

——o——

COMPARATIVE CUPOLA PRACTICE.*

By W. S. McQuillan.

At the January meeting of the New York Foundry Foremen the subject of cupola practice and melting ratios was brought up for discussion. Accordingly a list of questions was submitted to about 30 foundrymen, and they were requested to answer as accurately as possible regarding the working of the cupolas in their charge. About 20 answers were received, most of which have been tabulated in Tables I. and II. for comparison. Some were received which were not fully carried out, and could not, therefore, be used very well, and still others, owing to the odd construction and shape of the cupola, could not be analysed for comparison, and had to be left out of this paper.

While some of these records would make interesting studies in themselves, the figures in the tables are approximate, and while it is not claimed that they are correct in every particular, it is believed that they are a fair comparison and show the results obtained from a number of different cupolas, with the varying conditions under which they were worked.

* Paper read before the American Foundrymen's Association.

Fuel.

The volume of coke was figured from 100 lbs. of good Connellsville coke which measured 5,246 cubic in. and of hard coal, at about one-half the volume of coke, as it was found that some foundrymen use coal and coke on their bed fit for use at this temperature, as it would be so near the actual melting point that it would quickly chill back to the solid state before it could be poured. As this temperature causes the metal to just run, it is evident that it must be treated much higher in order to have

TABLE I.

Report	1	2	3		5	6	7	8	9	10	11	12	13	14	15
Diameter of cupola in inches	32	35	42	42	27	44	44	54	54	58	48	56	60	60	72
Area of cupola in square inches	804	962	1,385	1,385	572	1,521	1,521	2,290	2,290	2,642	1,809	2,463	2,827	2,827	1,071
100 pounds fuel will fill, inches	6.6	5.6	2.3	3.8	9.3	3.5	3.5	2.3	2.3	2.0	2.9	2.2	1.9	1.9	1.3
Weight of fuel on bed, pounds	450	650	1,000	650	350	1,300	1,000	1,400	2,000	2,000	1,300	3,000	1,700	1,800	2,500
Height of fuel on bed, inches	30	36.5	23	26	32	45	31.5	32	46	40	36.5	66	32	34	50
Height of fuel bed above tuyeres, ins	21	29.5	11	15	20	28	25	24	32	24	22.5	40	30	22	26
Height of tuyeres from sand bed, ins	11	7	12	11	12	12	9.5	7.5	14	16	14	25	2	12	24
Weight of coke above tuyeres, pounds	278	470	520	400	216	940	628	800	1,390	1,200	800	1,600	1,575	1,150	1,300
Weight of iron on bed, pounds	1,000	1,300	4,500	1,400	700	3,000	1,000	3,000	6,000	6,000	4,000	9,000	6,000	5,000	7,000
Ratio fuel above tuyeres	3.5	2.8	8.6	3.5	3.2	3.2	1.6	3.7	4.2	5.0	5.0	5.0	3.8	4.7	5.4
Ratio fuel on bed	2.2	2.0	4.5	2.3	2.0	2.3	1.0	2.1	3.0	3.0	3.7	3.0	3.5	3.8	2.8
Weight fuel succeeding charges, lbs	110	125	250	100	90	175	110	300	650	400	200	450	2,000	350	600
Ratio fuel succeeding charges	8.7	10.4	8.0	10.0	4.4	11.4	1.3	10.0	8.8	4.1	10.0	10.0	10.0	11.4	11.7
Weight of iron succeeding charges, lbs	1,000	1,300	2,000	1,000	400	2,000	1,500	3,000	4,000	4,000	2,000	4,500	2,000	4,000	7,600
Total weight of fuel, pounds	1,250	1,850	1,935	2,150	2,000	3,075	2,040	4,800	8,500	4,400	4,100	12,000	6,600	6,600	12,700
Total weight of iron, pounds	8,000	14,000	12,000	16,000	8,000	27,000	14,800	33,000	64,800	30,000	32,000	100,000	49,500	50,000	127,500
Grand ratio	6.4	7.5	6.2	7.6	4.0	8.8	7.2	6.9	7.5	6.3	7.8	8.0	7.5	8.3	10.0
Kind of fuel used	Light Coke	Coke	Coal & Coke	Coke	Coke	Coke	Coal & Coke	Coke	Coke	Coke	Coke & Coal	Coke	Coke	Coke	Solvay Coke
Fuel weighed or measured	M	W	M	M	W	W	W	W	M	W	M	W	M	W	W
Time of putting on blast, P. M	3:00	3:00	3:00	3:00	3:00	3:30	3:15	2:15	2:10	2:00	1:50	3:00	2:45	2:15	2:00
Time first iron melted, P. M	3:10	3:15	3:15	3:05	3:07	3:45	3:30	2:25	2:30	2:15	1:57	3:05	2:46	2:30	2:15
Time first iron tapped, P. M	3:20	3:20	3:30	3:10	3:15	3:50	3:48	2:30	2:50	2:25	2:01	3:20	2:51	2:50	2:22
Total time of heat from blast	2:20	1:30		1:30	1:05	2:00	1:30	1:50	3:00	1:30	3:40	4:30	2:15	2:20	9:45
Iron melted per minute, pounds	130	155		175	125	225	158	300	360	333	145	370	367	360	567
Class of work made	Gas Engine	Plate	Job	Light Job	Job	Boiler & Plate	Pumps & Job	Stove Plate	Boiler & Radiator	Pipe	Pig Job	Med. Light	Rolls	Plate	Sanitary & Plate	Electrical
Diameter of blast pipe, inches	12	16	14	14	8	15	12	17	18	20	16	24	18	18		24
Area of blast pipe, square inches	113	201	154	154	50	176	113	227	254	314	201	452	254	254		452
Number of tuyeres	6	6* 2½	6	6	6		6	6	6	6* 3	6	12	8	6		
Size of tuyeres, inches	4½ x 6	5 x 5	4 x 10	6 x 6	4 x 6		2½ x 11	4½ x 13	10 x 7	7 x 12	4 x 6	6 x 12	4½ x 7½	7 x 10		
Area of tuyeres, square inches	116	170	240	144	144	336	193	429	420	546	144	648	270	420		706
Height of charging door, feet and inches	12	11 6	12	12 6	9 10	11	7 10	9 3	11 6	9	9 9	13 10	9 6	10 6		14
Pressure 20 minutes after blast, ounces	16	16	12	8		9½ After 6 tons.	13	13	14	16	8	16	8	8	.3½ Every top	
Slag is drawn					*5	125			40 per ton		50 per ton				50 per charge	
Weight limestone or shells, pounds																
Do you mill sprue?	No	Yes	No	No	No	Yes	No	No	Yes	No	No	No	Yes	No	No	
How often do you line up, months	6	6		6		6	3	6	10	7	6	8 to 10	6	12	6	

*Six top and six bottom.

charge. It has been stated that the cupola is one of the simplest devices for melting cast-iron, which may be true, but where speed, economy, and quality are desired, a thorough knowledge of the conditions and workings of the cupola are very essential. There are certain fixed laws governing the melting of iron in a cupola. the iron retain its fluidity after being taken from the cupola. It is generally understood that the portion of the fuel below the tuyeres is not capable of giving this extra heat, and hence the metal must receive it before it drops below this point. We must, therefore, look to the fuel above the tuyeres to furnish this

TABLE II.

Report No	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Diameter of cupola in inches	32	35	42	42	27	44	44	54	54	58	48	56	60	60	72
Area of cupola in square inches	804	962	1,386	1,386	572	1,521	1,521	2,290	2,290	2,642	1,810	2,463	2,828	2,828	4,072
Tuyere area in square inches	116	170	240	144	144	336	198	429	420	546	144	648	270	420	106
Ratio of tuyere area to cupola area	6.93	5.66	5.57	9.62	3.97	4.23	7.68	5.33	5.45	4.83	12.84	3.80	10.47	6.73	5.76
Blast pressure in ounces	16	16	12	8	9	9	13	13	14	16	8	16	8	8	13
Melt in pounds per square foot per minute	9.54	19.45	....	18.19	15.12	20.87	15.22	18.87	22.84	18.14	10.08	21.60	18.80	18.40	20.06
Fuel bed above tuyeres, in inches	21	29.5	....	15	20	33	25	24	32	24	25.5	40	30	22	26
Ratio of first charge	2.2	2.0	....	2.3	2.0	2.3	1.0	2.1	3.0	3.0	3.7	3.0	3.5	3.8	2.8
Tuyeres from sand bed, in inches	11	7	12	11	12	12	10	8	14	16	14	25	2	12	24

If the conditions are made proper and in accordance with the requirements of the laws, certain definite results are bound to follow. A given quantity of heat imparted to a certain amount of iron will bring about the change which we call "melted." Cast-iron melts, ordinarily, at about 2,200 degrees Fahr., but there are few foundrymen who would find it heat as the metal drops through on its way to the bottom. So we find that the height of bed above the tuyere is of much importance in giving us good hot iron quickly. If the bed is low, it may melt, but dropping as it does directly into the cold blast as it enters the cupola, it is cooled, and the result is dull iron. We can easily understand by the blocking of

the fire, in front of the tuyere after the blast is put on, the effect of the cold air upon the melted metal.

There is the other extreme, having the fuel bed too high above the tuyeres. In this case the intense heat existing in the melting zone is applied to the fuel above it instead of acting directly upon the metal. We have not only a waste of fuel, but a waste of time awaiting for the excess to burn away sufficiently to bring down the irons to the melting zone where they will be melted. Therefore, the height of fuel above the tuyeres is of much importance in getting good hot iron in the shortest time. Care should be taken to see that the bed is neither too high nor too low.

Cupola Efficiency.

The theory has been advanced that a cupola would melt faster around the edges than in the centre. Others have claimed that the centre would melt the faster. This is not proven by the figures, as we find that a 35-in. cupola melted 19½ lbs. to the square foot per minute, while a 72-in. cupola melted only 20 lbs. to the square foot per minute. As the iron from the 35-in. cupola was used for stove plate, we must assume that it was very hot. We also find a 48-in. cupola melting over 15 lbs. per square foot per minute, but this may be accounted for by the figures shown. We find that at least two conditions in the 48-in. cupola are opposed to fast melting, namely, the use of part coal, and the proportion of tuyere area to the cupola area, which is one to thirteen. Further, only 8 ozs. of blast obtains, which would indicate that not enough air was furnished this cupola. On the other hand, we find a 56-in. cupola melting over 21½ lbs. per minute per square foot. In this cupola we find the proportion of tuyere area about one to less than four, with a blast pressure of 18 ozs. We also note that the two 54-in. cupolas, Nos. 8 and 9, are about equal in tuyere area and blast pressure, but No. 9 melts over 22½ lbs. per square foot per minute, while No. 8 melts a little less than 19 lbs. per square foot per minute. Here we might assume that the higher fuel bed of No. 8 was the factor which gave No. 9 the faster speed of melting. Now if we turn to No. 10, a 58-in. cupola, we find a still larger proportionate tuyere area and a smaller ratio per square foot per minute with a higher blast pressure (16 ozs.). Here again, we might assume that the fuel bed above the tuyeres is not high enough to produce the best results. As we must remember that the blast pressure will cool a large part of the fuel and raise the melting zone, so we will say, if this fuel bed was 6 in. to 8 in. higher, the melting rate would be more in proportion with No. 9, or if the blast pressure was reduced to 2 or 3 ozs., faster melting would result. We may also note No. 4, a 44-in. cupola melting 18.19 lbs. per square foot per minute. The tuyere area here is about 9½ to 1. The blast pressure is low for this proportion but we may also note that the fuel bed is low, and maintained so by small succeeding charges of fuel and iron. In this cupola we have personal knowledge of the good quality and temperature of the metal produced, and believe these conditions to be due to blast and fuel being kept in good proportion.

Conclusions.

From these few comparisons we arrive at the conclusion that fuel and blast must be kept in certain relations to obtain fast and economical melting. There are many other studies that could be made from the tables presented from which you may draw conclusions which doubtless would tend to establish the following facts :—

That with a high fuel bed and a high blast pressure the melting zone is raised, and a cooling of the fuel around and above the tuyeres results. It also chills the iron and slag over the tuyeres and causes the cupola to bung up at this point.

That a high fuel bed and a low blast pressure cause delay and waste of fuel by having to burn out a portion before the iron will reach the melting zone.

That a low fuel bed and a high blast pressure will cause dull iron by cooling.

There is one other condition which affects the melting ratio, and perhaps contributes more to the waste of fuel than any other. This is the height of tuyeres from the bottom. Also the construction of some cupolas having two rows of tuyeres. As we must consider the fuel below the tuyeres as only a foundation to keep the effective fuel at a proper height, and as these high tuyere cupolas have for their object the holding of metal in the bottom sufficient to pour large pieces, this provision would seem unnecessary.

As we will note by referring to No. 13, the tuyeres in this 60-in. cupola are but 2 in. above the sand bottom, and the iron was used to pour very light work and

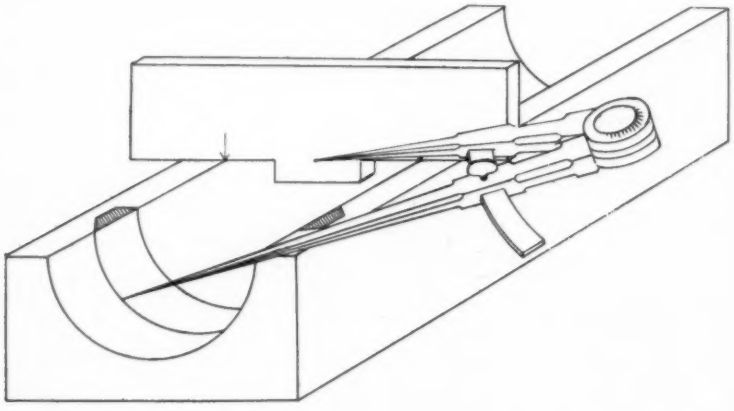
ran in a stream at the rate of 370 lbs. per minute, filling a 2,000-lb. ladle in a little over five minutes. It could be held for some time, retain its heat and be free from slag and dirt.

Further than what has been shown, we do not desire to make a comparison as to the melting ratio. Different kinds of work may be poured at different temperatures, which fact should be taken into consideration in the study of the tables. We do not claim to be cupola experts, but believe that you will find the figures given of interest to you.

—o—

TO DRAW LINES INSIDE A HALF-ROUND CORE-BOX.

THE sketch, which is self-explanatory, shows a very useful arrangement not generally known, the use of which will be appreciated by pattern-makers, whereby lines can be drawn parallel to the squared end of a half-round core-box with the aid of an ordinary pair of compasses.



The utility of this arrangement is apparent in cases where it is necessary to make a sinking in a core-box, similar to that shown by "hatched" lines on the sketch, at some point in the box where it is not possible to gauge the lines from the end.

A piece of wood is laid along the edge of the box as shown, and on this is marked a point into which the fixed end of the compasses work. The centre must, of course, be kept equidistant from the parallel edges of the box, and the free end of compasses will trace the cutting line round the inside of the box.

At first sight it might be thought the line described would be that of a semi-ellipse, but such is not the case. The line drawn lies wholly in the vertical plane, which is at right angles to the horizontal plane on which the parting or joint of the core-box lies.

—o—

COPPER FOR THE FOUNDRY.*

BY F. L. ANTISELL.

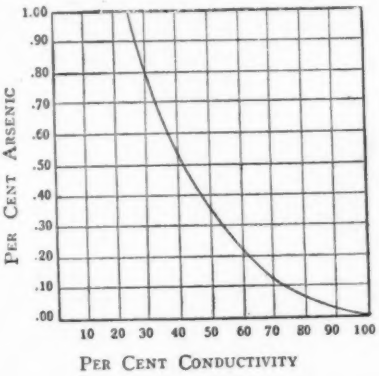
COPPER for foundry purposes is required to possess certain properties, determined by the specific use for which it is intended, and that particular grade should be selected which will fill the requirements of the work in hand. To this end the buyer should carefully consider the following points:—

(1) Brand.
(2) Conductivity.
(3) Analysis.
(4) Shape.
(5) Appearance, *i.e.*, colour, pitch, etc.

The brand, which the writer considers as first in importance, conveys the greatest amount of information to the buyer of copper. It insures uniform quality aside from the chemical analysis (as various

* Paper read before the American Foundrymen's Association.

brands of copper vary somewhat in pitch, or, say, if you like, gases or oxides), which fact is of great practical advantage to the mixer of copper alloys, as the melting can be conducted largely by a pre-arranged schedule, for a reliable brand of copper can always be depended upon to run uniform, whereas, while the unknown or unbranded ingot may represent the very best grade of copper obtainable it, on the other hand, may be only capable of producing a casting of inferior quality. Again, certain brands stand for a reputation that has required a vast amount of capital to create and a large plant to produce. It is evident that a non-uniform brand of copper would jeopardise the business of the producing plant. To guard against this possibility, makers of various brands use every precaution to keep their products uniform in quality, it being not unusual to cast over 100,000 lbs. of ingots at one charge, 12 ingots being cast simultaneously every 20 or 30 seconds. This large bath of copper is



constantly under the inspection of metallurgists, chemists, and physical scientists. It can be said as an almost universal truth that writers on this subject invariably recommend the purchase of branded ingot copper only. However, with the advent of the foundry chemist, and with a good conductivity bridge, microscope and accessories, this situation will probably change to some degree in the future.

Conductivity.

Conductivity may be well considered second in importance only to the brand, as it can be said within certain restrictions to be a measure of the ultimate quality of the metal. This test should be carefully conducted with an apparatus of modern design. For the foundryman the best results will be obtained by drawing into wire a specimen of the ingot and testing the hard-drawn wire. The number of dies varies with the grade of copper. The same specimen can then be tested for tensile strength.

If the conductivity of hard-drawn copper wire is 98.75 per cent. (Mathiessen's standard), it will represent a conductivity of about 101 per cent. if properly annealed. Should any impurities appear, the conductivity will be lower according to the specific resistance of the alloy and quantity of various elements.

The accompanying illustration shows graphically how the occurrence of even the most minute quantity of arsenic will vary the conductivity of copper. Thus, in annealed copper wire with a conductivity of 100 per cent. we would hardly expect to find more than a trace of arsenic. Curves for the different elements show in an interesting manner the effect of impurities in copper. However, high conductivity in itself does not prove conclusively that between two specimens the higher in conductivity is the more siutable for casting purposes. Within certain limits copper may contain impurities in an oxidised condition, thus reducing the resistance of the specimen as a copper alloy, but at the expense of its tensile strength, whereas, on the other hand, the impurity occurring in a metallic state must necessarily reduce the conductivity, and in practically all cases increase the tensile strength. Thus the conductivity test is of more importance when considered in connection with a tensile test, and though various investigators do not agree in general on the point, it appears that as the rate of conductivity increases the tensile strength decreases. The specimen for this test must necessarily therefore be treated for ultimate tensile strength only.

While copper refiners always give attention to the proper de-oxidising of the metal there is almost always present a small quantity of copper oxide that does not appear to decrease either its conductivity or tensile strength.

Analysis.

In buying copper on analysis it is generally sufficient to specify the total copper contents. Copper running 99.90 per cent. pure is suitable for the highest grade of copper alloy, and no distinction is necessary in specifying its origin as "Lake," "Electrolytic," etc. The per-

centage of copper contents may decrease steadily for different requirements according to the nature of the impurities. The principal impurities are arsenic, antimony, iron, sulphur, bismuth, selenium and tellurium.

Shape.

The shape of ingots varies with the individual tastes of refiners. In fact, it is not unusual for copper refiners producing two or more grades of ingots to make them up into different shapes, thereby reducing the probability of mixing qualities. It would appear that a standard shape and weight of casting copper would be very desirable, and should receive some attention from the brass founder. The ingot has in many cases increased in thickness until its weight is close to 20 lbs., and often possesses but two heels, making it too heavy to be easily cut apart.

The principal shapes of casting copper in the market are:—

1. The old fashioned three-heeled ingot.
2. The newer form of two-heeled.
3. The ingot bar.
4. The multiple ingot bar.
5. The slab.

These shapes all have advantages peculiar to themselves, but it would seem that the old-fashioned ingot bar is more than holding its own, and is generally preferred by brass founders.

The ingot bar consists of a number of ingots cast continuously, end to end, generally in groups of three three-heeled ingots, the ends being joined by a thin gate, forming an extra deep notch to facilitate detaching the individual ingots.

The multiple ingot bar is formed by several ingot bars cast side by side and connected at several points by gates. These bars must necessarily be cut apart before melting, and when adequate facilities are not at hand to separate them, the final cost is somewhat greater than for the ingot weighing, say, 20 lbs., although the latter has probably to stand a charge for cooperage. Furthermore, the ingot bar when cut apart presents sharp corners that have a tendency to abrade and shorten the life of the crucible.

To get economical results from the slab, it is necessary to use a substantial shearing machine, capable of cutting the slab into pieces of proper size to be placed in the crucible, and the cost of this work must be charged against the shape as an offset to the saving in shipping expense.

Appearance.

If the author of the saying, "Appearances are deceiving," had in mind copper when making this remark, he could hardly have explained the situation more clearly. If there is one thing impossible, it is to judge the quality of copper by the colour of its skin.

The terms, "rose red," "brassy," "black," mean nothing in regard to quality; the most beautiful rose-coloured ingot may contain one-half per cent. of arsenic, while the blackest looking ingot ever made may be 99.99 fine. The various colours are due almost entirely to the temperature of the copper and pickle when the casting leaves the mould. The pitch on the back of the ingot should be fairly flat with a uniform wrinkled top surface, and without sharp corners.

—o—

SANDLESS CASTINGS.*

By John H. Shaw.

Casting in so called chil's is a method well known at the present time. Outside of the making of rolls and ingot moulds, we find the method used for making bedsteads, sash weights, and other simple castings where there is no difficulty from undue expansion and contraction. The troubles arising from an iron mould and the lack of understanding the regulation of temperatures in casting into chills have caused many a failure of an otherwise good idea.

The greater part of these objections have been overcome by the construction of a peculiarly arranged mould, as shown in Figs. 1 and 2. The parts of the mould are so arranged that they automatically open out sufficiently to take care of the expansion due to heating without destroying the correctness of the castings made. The further manipulation of the moulds in filling them with molten iron depends upon a proper knowledge of the temperature they must be kept at to ensure the best all-round results.

Construction of the Mould.

The mould is constructed essentially in two parts; the outer shell which may be locked readily, and the inner dies in close contact with the shell, and securely fastened to it. The design of the mould is such that expansion in two directions may readily take place unhindered except

* Paper read before the American Foundrymen's Association.

for powerful springs. The arrangement of dies and shell allows of a ready replacement of the former when damaged, this depending upon the thickness of the mould and the temperature they are allowed to reach, their composition, of course, being such that a melting point is attained. Further attention is given to the moulds in designing them, so that they may be closed and opened very quickly, and thus rapid work accomplished.

Operating the Mould.

In operating a sandless mould it is necessary to coat the metal in contact with the molten iron occasionally with a compound containing graphite and crude oil or other refractory substance carried in a vehicle which in being driven off by heat will not ruin the surface of the casting.

The moulds should not be allowed to get too hot; that is, beyond 900 degrees Fahr., otherwise they are liable to expand permanently and cause trouble.

Coating the Dies.

It is only necessary to coat the dies every fifth pouring, more or less, the idea being to get a thin layer of the refractory material evenly spread over the face of the dies, which layer is properly kept up. Between this and a hot mould, and fairly soft iron, no undue chilling effect results in the casting beyond the very desirable closing up of the grain of the metal. In the case in point, the making of brake-shoes, every fifth cast requires a spraying of the mould.

The system can, of course, be adapted to mechanical elaboration in order to get the lowest shop cost. Thus by perform-

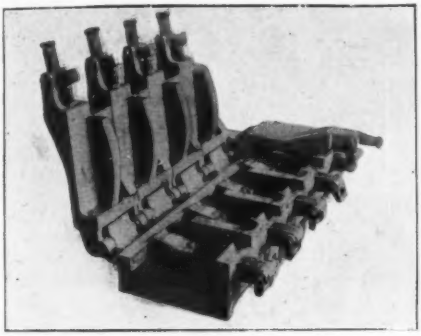


FIG. 1.—BRAKE SHOE MOULD.

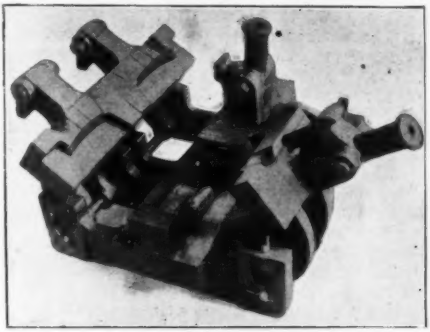


FIG. 2.—ANOTHER TYPE OF BRAKE SHOE MOULD.

In operating the mould, after spraying it, the first few castings are rejected, the intention being to heat up the mould, though in continuous work this may be accomplished in a special heating furnace or oven if desired. All cores are set in the regular way before casting. The metal is poured in rapidly and the mould opened as quickly as possible, provided that the metal is set sufficiently that no bleeding takes place. The elastic condition of the mould, however, prevents trouble if this time is not kept properly and the casting allowed to remain in the mould too long; the disadvantage of such a procedure in allowing the mould to heat up too much is naturally evident. The casting is then taken out and piled up so that the whole mass may cool slowly, so that the chilling effects of too rapid cooling may not cause hard spots.

ing many of the small operations automatically, by special devices, or arranging the moulds to pass the point of pouring, much labour can be saved. The work that can be made by sandless moulds is naturally of a standard kind, where large quantities of the same piece are required. Hence its introduction for the brake-shoe, iron bedstead, and other work. Moreover, for the car wheel, the usual cold chill, with a suitable adaptation of a centre core, makes a very easily handled wheel.

Disadvantages.

In presenting a method to the foundry, it is always well to look at both sides of the problem, that is to show its advantages and disadvantages. Here are the latter.

The sandless mould is best adapted only

to work of fairly large size, though practically everything can be made in this way if proper care is taken in the niceties of the construction and manipulation.

The heating of the mould consumes some time, and uses metal which must be returned to the cupola, though this can be avoided by heating in the oven. Moulds are naturally expensive at first, and hence advisable only when a large number of castings are to be made of a kind.

The red hot castings, if small, where machining is to be done, or special requirements are demanded, must be practically annealed, either in pile or by an oven. The silicon of the metal also must be a little higher than for sand castings.

Advantages.

The advantages are as follows:—

A limited number of moulds will make a large number of castings with very little labour, and this is not high class.

The surface of the castings being practically smooth and accurate in dimensions, the loss of extra metal through excessive rapping of patterns in sand work is avoided, and no expensive cleaning department is required beyond some little grinding of thin fins.

The life of the moulds is long, as may be seen in ingot moulds for brass and iron bedsteads.

The foundry plant is very small for a heavy tonnage.

The process is adaptable for continuous melting and operating.

Interchangeability of the dies in the shell makes it easy to keep the moulds up to standard, and these dies being of cast iron are inexpensive.

The installation of an expensive power plant is eliminated, the only power required being electricity sufficient to run the cupola blower.

——o——

THE proposed combination of Scottish structural engineering works has now been effected by the purchase and incorporation by A. and J. Main & Company, Limited, Clydesdale Iron Works, Possilpark, Glasgow, of Arrol's Bridge and Roof Works, Germiston, Glasgow.

MESSRS. PRINCEPS & COMPANY, Princeps Works, Sheffield, have appointed Mr. E. B. Clarke, of Norfolk Street, Sheffield, as sole agent for their specialities in South Yorkshire, Nottingham, and Derby. The Company have also appointed Messrs. E. Bowden & Company, of Merchant's Exchange, Bute Docks, Cardiff, as their agents for South Wales.

COST ACCOUNTS.*

By H. F. J. PORTER.

WE frequently see the statement in print and more frequently hear it said that although the value of principles of cost accounting has been recognised for some twenty-five years, still it has been only a comparatively short time since manufacturers generally have established cost accounting systems in their plants and thus know accurately what their product is costing them. Now, while I am willing to concede the fact that cost accounting has to a very large extent become recognised as a permanent feature in the financial end of a great many industrial enterprises during recent years, still I know from personal experience that it does not follow as a corollary that the accurate cost of production has in every instance been attained.

But presuming for the moment that the result mentioned has actually been accomplished, I feel that I am safe in stating that there is a wrong conception in the minds of many people as to what the function of a cost accounting system really is. I have heard people who have had a system of cost accounting installed in their plant say that they were disappointed in its not accomplishing the saving that they had been led to expect would be brought about by its introduction; that on the contrary, there had been an increase in expense by just the amount it cost to run the cost system. To my mind, and to the minds of many who have had to do with manufacturing enterprises, the aim of an efficient cost system should not be to determine simply what a product costs, but rather why it costs what it does. People nowadays are not satisfied to be informed that a condition exists, but demand to know the reason why, so that if necessary it can be modified intelligently. It is intelligent action on the information presented by the cost system that accomplishes the saving, and not the system itself that does it.

This result is by no means always attained by cost systems, as they are generallly operated, and while there are many and diverse reasons for this, the foremost is the expense of installation and operation, and I want to emphasise strongly the distinction which I shall make later between these two operations, viz:—the installation and the subsequent operation.

* Paper read before the American Foundrymen's Association.

Installation of Cost System.

First of all, it requires a competent and experienced man to design and instal a suitable and comprehensive cost system. The services of such a man are in great demand just now and, therefore, necessarily come high, and this expense, together with the cost of employment of those who are subsequently to operate the system, all of whom will swell the ranks of the non-producers, deter many from making the proper investment. In fact, I have heard some people say they feel perfectly able to instal their own system, and resent the suggestion that an outsider do it for them as a reflection upon their own competency.

These people do not recognise the distinction between the ability to design and instal and the more simple qualification to subsequently operate. The first is that of a recognised specialist, the latter that of a first-class bookkeeper. Very few have the former, but all concerns have the latter in their employ. The only way they could be considered competent would be by having on their regular staff a man of the first type, and if they were thus equipped the inference would be that they were paying continuously too much for occasional expert supervision.

There is no more need for the continuous service of such a man in an ordinary business than there would be, for instance, for an engine designer in the same business. When an engine is to be bought to operate a plant, people do not design and build one. They go to a firm of engine manufacturers and get them to supply a suitable engine and instal it. The subsequent operation of the engine is another matter that is entrusted to regular mechanics. And so the now recognised profession of constructive accountancy should be similarly dealt with, if what is wanted is to obtain the character of cost system, which is needed in a growing business, viz.: one which is adapted especially to its needs and will be flexible enough to adapt itse'f to changes as they develop.

The essential features of this system of costs must conform to the general commercial accounting system of the business, so that they merge and become one. After the system is installed, it can be handled by the staff of book-keepers already employed, with such additions as the increased amount of work necessitates. The type of manager which every industrial enterprise should have nowadays is one who has received some technical education, and will be able to analyse the statements presented regularly by the cost system, draw his deductions and act intelligently upon them. In other words, the subsequent success of the cost system will be measured by the ability of the manager to make use of it. Those who do not have a cost specialist on their staff, if they feel as I have intimated some do feel about securing an outsider of this type, when called upon to develop a system of cost accounting, are very apt to fall back on their own resources and put in a simple "Labour and Material Record" account, distributing the general expense over the output according to the ratio of direct to indirect labour. This gives the cost of product, according to their notions, and they let it go at that until competition suddenly opens their eyes to the fact that there must be something wrong somewhere, and then there is trouble for somebody, and generally the most innocent suffers.

Cost Specialist.

There are, however, many concerns who have realised the nature and value of the work of a cost specialist, and have gone to the expense of having a high-grade system installed. But it is surprising how few of even these systems remain operative at their full efficiency. This failure to secure the desired result after the lapse of time seems to be due to the lack of recognition of the human element in the office force engaged in the work. It takes a good man to keep a high-grade cost system abreast of the demands of a growing business. Good men are always in demand, and a day arrives when this good man finds an opportunity presented whereby he can better himself. Here again the hesitancy to increase the cost of the non-productive element in the business asserts itself, and he is allowed to go. His successor is either a new man or one advanced from the ranks. He suggests changes, simplifications, cutting out of what he or others consider superfluous records; these changes do not work out as well as was expected, others are substituted, and before it is realised, the system has lost its vitality and flexibility and degenerates into a simple "Cost of Product" system.

Simple Systems.

Now, these "Simple Systems" which cost so little to operate, are rarely accurate in their results, and are not productive of the saving that was expected. Simple engines do not require

expensive men to handle them, but there is, on the other hand, a continuous draught upon the coal bin, the oil tank and elsewhere. And so it is that in the saving in operation of the simple "Cost of Product" system there are leaks in the labour and material accounts which do not localise themselves, and therefore, are not apparent.

There is no part of a manufacturing business where metals are handled that receives as little attention in the cost department as that which deals with the raw materials. It is generally supposed that where materials are roughly handled in bulk by unskilled labour, no accurate methods of accounting can be applied, and consequently the most crude records, both of time expended and materials handled, are kept. Averages only are dealt with, and in some instances records are taken only at intervals to see whether conditions change. Such records are worse than valueless; they are deceptive, and the principal object of a cost system is to prevent deception.

Cost Variations.

The best way to become convinced that records taken at intervals are unreliable, and therefore unsatisfactory, is to translate them into graphical curves. It will then become apparent, by the distance between the peaks and depressions in the curves, how greatly costs can vary, and when gaps occur, regret will be felt at the lack of knowledge of what has happened during the intervals, and there will be a constant tendency towards requiring that records be supplied regularly, so that the curves will be made continuous.

The value of a statement when made by itself may be small, and yet when compared with some other similar statement, its full bearing on the subject under consideration is shown, and its importance may become very great. Curves show the relative importance of grouped statements, and any variation becomes so striking to the sense of sight as to demand instant investigation.

Let me then urge the advisability of keeping records of the cost of each item of your output every day and all day. Find out what each item costs, so as to learn which is paying and which is not. Try to change, however, so many different kinds of your manufacturing methods so as to make your unprofitable product pay, and if you find you cannot do so at market prices, then drop it and let someone else who can, make something on it.

Try to systematise your processes so that there is a continuous flow of product from the receiving of the raw material to the shipping of the finished product. Remember that every machine and every man in the plant represents capital invested; that when machine or man is idle, just so much capital is not drawing interest, and that the more the machine and the man produce in a given time the greater is the interest on the capital invested. A part of this interest is one of the factors of the profits of the business; the other part should be set aside as a fund to make good the antiquation and deterioration of the machine, and for a long service pension for the man when he also has worn out. The more continuously the machines operate the better interest they pay; therefore, do not change the work they are set up to perform oftener than is necessary. The more continuously men work the better interest they pay, for they are keeping the machines from being idle.

Therefore, it will pay to employ men who are steady, who are at their machines every day and all day. These men, even if their output per hour is lower than that of others, who are classed as better mechanics but who are less steady, deliver a greater output per week or per month at less cost. A high grade cost accounting system in the hands of scientific management will bring individual plants to their highest efficiency of operation.

In any independent industry it is possible to get the individuals who comprise it to co-operate towards a standardisation of methods of cost accounting. If the making of castings stood independently as an industry, a movement of this kind in it would be of very great advantage There are industries which incorporate a foundry as a regular department in their business that it would be impossible to attempt to do more than suggest, by establishing precedents, the general lines which it would be advisable for them to follow. This you can do, and I hope that your initiatives will be followed.

——o——

THE HARRINGTON IRON WORKS and other valuable property, belonging to James Bain & Company, have been acquired by a private partnership, consisting of Sir John Randles, M.P., chairman of the Moss Bay Hematite Iron and Steel Company; Mr. Joseph Elkins, managing director of the Workington Iron Company; and Mr. W. Burnyeat, director of the Moss Bay and other companies.

LIST OF NEW INVENTIONS.

Specially compiled for THE FOUNDRY TRADE JOURNAL by MR. GEORGE BARKER, Fellow of the Chartered Institute of Patent Agents, Consulting Engineer and Chartered Patent Agent, 77, Colmore Row, BIRMINGHAM.

20,683. S. O. COWPER COLES. Improved process for the recovery of metals from their ores or from residues or other substances containing metals.

21,063. H. M. SUTTON, W. L. STEELE, and E. G. STEELE. Improvements in or relating to dry concentration of ores.

21,348. H. CUSTANCE and R. A. F. W. LAGERWALL. Improvements in or connected with moulds for casting metals.

21,455. E. REINCKE. Improvements in process for utilising foundry waste.

21,482. E. J. JENKINS and R. JENKINS. Improvements relating to moulding or foundry casting boxes and parts connected therewith.

21,560. E. S. LERMIT. Process and apparatus for the production of moulds for casting hollow articles.

21,638. P. MARTIN. Improved process and composition for the treatment of iron or steel to prevent rust or erosion.

22,028. J. W. PATON. Improvements in or relating to the manufacture of plated or coated iron and steel sheets.

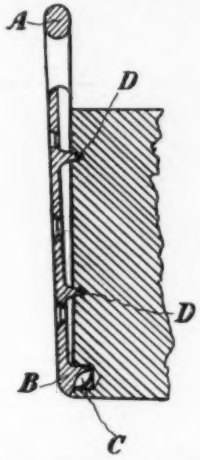
28,661. J. MAJOR, Ashton-on-Mersey. An improvement applicable to wooden or other patterns used in casting metals.

This invention is applicable to the heavier class of wooden or other patterns which are usually fitted with a flat metal lifting rod or plate at each side or end, provided with a hole or hook at the upper end for lifting the same.

These rods are usually attached to the pattern by ordinary screws which frequently become loose, and in raising the pattern from the mould, the rods and screws are then liable to injure the mould.

The figure shows a vertical section through the lifter A, which is provided at or near the lower end with a stud B, which fits into a hole C on the pattern. These studs thus bear the whole weight of the pattern when it is being lifted thereby, taking all strain off the screws and preventing their liability to become loose and injure the mould.

These plates are preferably made of cast steel, and may be flat or curved or



trough shaped in cross section, and in this latter case to increase the stability of the screws projections or spikes D are cast on the lifters, and these pierce the sides of the pattern and thus give a better grip.

CORRESPONDENCE.

To the Editor of the FOUNDRY TRADE JOURNAL.

SIR,—As a constant reader of your journal, I venture to ask if you or any of your readers could give me any information about the working of manganese bronze, its strength, its conduct under temperature, its general difficulties in casting, how to obviate them, and the best methods of manipulation for castings to stand air and fluid pressures. There appears to be almost unlimited possibilities bound up in a material productive of such strength that lends itself to suitability for casting propeller blades and other parts of fittings used in the mechanism of H.M. warships. Hoping I may have the pleasure of obtaining some information.

I am,

Yours, etc.

"INQUIRER."

CRUCIBLE TONGS.*

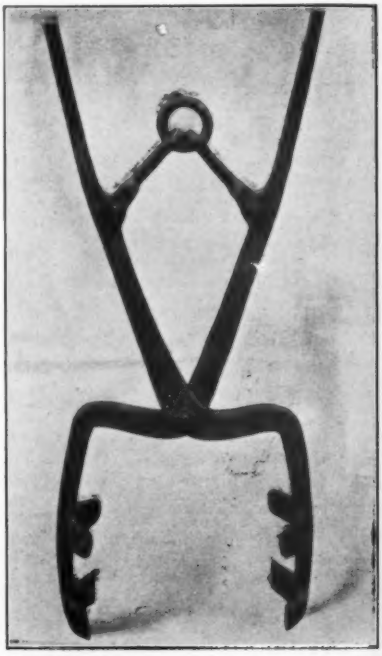
By Audley A. Johnson.

The life of a crucible is influenced largely by the handling, and second only in importance to the annealing and the first heating is the fit of the tongs and the kind of tongs used. There are three general styles of tongs in use, which may be classified as follows :—

One-pronged tongs;
Two-pronged tongs;
Spade tongs.

The latter is so named because the bottom part is shaped like the ace of spades. These three styles may be either of the ring pattern or the grab pattern, as shown in the cuts.

The one-pronged tongs may be satisfactorily used on small crucibles only, but for sizes above No. 40 the two-pronged tongs should be universally used. It is a matter of no vital importance whether the bottom prong is of the spade pattern or like the illustrations. The main thing is to have them fit the crucible perfectly from the bilge or widest part of the pot down to within 2 in. or 3 in. of the bottom. If the tongs come too near the bottom of the crucible, they are liable to interfere when setting it into the shank. If too much space is left, the pot is liable to be squeezed.



It should be borne in mind that the crucible tongs should take hold of the pot below the bilge and lift it out of the fire with the least possible pressure, just the same as if it was picked up in the shank or in a basket. It may be said that it is impossible to put the tongs low enough down on the crucible in a coke or coal fire, and, under certain conditions, this may be the case, but we are quite sure that in nine cases out of ten, if the furnace is of the proper construction and the firing intelligently done, that there will be no necessity for lifting the pot twice, first out of its bed by taking it with the tongs above the bilge, thereby not only injuring the pot but pressing the tongs out of shape, and secondly,

* From "Graphite," a publication issued by the Dixon Crucible Company, 26, Victoria St., W.

placing the tongs where they belong and bringing it from the furnace. The fuel space around the crucible and at the bottom should be sufficient so that one firing will take off the heat. In the case of smelting and refining companies, who are melting light scrap, this may be impossible, but with the rank and file this can easily be done. The consequence is that when the crucible is ready to pull the fuel has settled down and practically disappeared, and there is no trouble about putting the tongs where they belong.

The spade pattern tongs were designed to push the fuel away as they went down alongside the pot, but they have not quite the bearing surface of the two-pronged style.

In the two-pronged pattern the lower prong does most of the lifting, and the upper prong steadies the crucible so it will not wobble, but both should fit snugly. In the illustrations it will be noted that there is ample space between the tongs and the side of the pot above the bilge, also that the tongs are square-shouldered. This is to prevent possible squeezing of the top of the pot. It is too often the case that the tongs are made with round shoulders so that, when they are placed well down, the first point of contact, as they close together, is the extreme upper edge of the crucible, and it is inevitable that pieces will be broken out of the pot.

We have seen large crucibles, size 200 to 300, lifted from the fire with one-pronged tongs which were bow-legged, that is, the first and only point of contact was the bottom of the lower prong, and it is plainly to be seen that this practice will soon cut the crucible in two.

We have also noted tongs that were originally of the two-pronged pattern, used on size 60 and 70 crucibles, with the lower prong cut off on account of the small space between the pot and the furnace wall, and the consequence was every pot of metal was lifted from above the bilge; also crucibles pulled from the fire with one-pronged tongs where the prongs were bent, so the crucible was tilted way to one side by the time it reached the top of the furnace, all of which can readily be seen is bad practice.

We repeat that the one-pronged tongs should be used only on the smallest pots, or for the purpose of setting an empty pot back into the fire. We recommend strongly the two-pronged pattern for all other work, and above size 60 tongs of the grab pattern, as shown in illustrations. Of course this necessitates some kind of a hoist, but when it is remembered that the weight of a No. 70 crucible full of metal, together with the tongs, is above 250 lbs., it will be plain that a hoist is not only a convenience but a necessity. The pressure on the pot is regulated by the weight, and with grab tongs properly designed and kept in shape, the pot cannot be injured.

On the small sizes, where ring tongs are used, the handles should be made light and springy and stand just the right distance apart when in position to receive the ring, so that it will be impossible to squeeze the pot. It must be remembered that the crucible in its white heat stage is soft and leathery, and there is enormous pressure exerted when the handles are forced together and the ring driven on, and, although no immediate bad results may be apparent, the crucible walls will be fractured little by little.

In well equipped, up-to-date foundries, two separate pairs of tongs for each size crucible are used, one for the crucible when it is new and another for the same crucible when it is half worn out. As the pot gets smaller after each heat, it is obvious that the tongs that fit a new crucible will be too large for an old one.

In some of the late oil furnaces they use tongs of the grab pattern, with the handles above the ring bent over at right angles; as there are no ashes or fuel to contend with in the oil furnace, the tongs go right to their place without effort, and these bent handles allow the operator to stand off to one side.

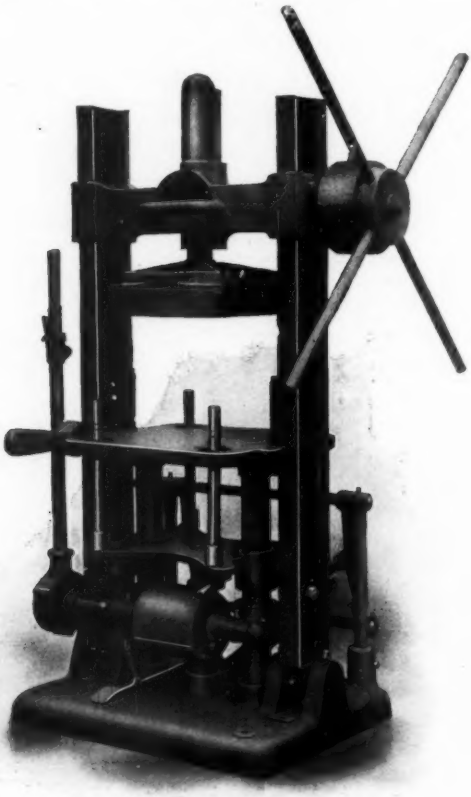
——o——

SAMUEL DENISON & SON, LIMITED, of Hunslet Foundry, Leeds, are supplying weighbridges to two Yorkshire Gas Works and one to the Glasgow Corporation for use at the Shettlestone and Tollcross refuse destructor.

THE advisory Committee for the engineering industry in connection with the census of production have held a meeting at the offices of the Board of Trade. There were present Mr. A Wilson Fox, C.B. (in the chair), Mr. A. Siemens, Sir R. Giffen, The Hon. S. P. Bouverie, Mr. A. Bornemann, Mr. J. Dodd, Mr. W. Collingwood, Mr. T. F. Woodfine, Professor S. J. Chapman, and Mr. H. W. Macrosty.

THE ENGINEERING AND MACHINERY EXHIBITION.

THE Engineering and Machinery Exhibition held recently at Olympia, London, included a number of appliances more or less intimately connected with foundry work. Among the more notable of these was a new moulding machine



"COVENTRY" MOULDING MACHINE.

exhibited by the BRITANNIA FOUNDRY COMPANY, and dubbed the "Coventry." The main feature about this machine is the mechanical gear in the head which enables any mould to be rammed as hard as it is required by manual labour only and without undue exertion. In fact, it is claimed that the machine enables work to be done by hand for the execution of which pneumatic or hydraulic power is usually called into requisition, thus effecting substantial economies in a foundry. The ram and lift, although hand-worked, are dissimilar from the lever and toggle joint mechanism employed in machines generally used for simple and shallow jobs. The ram works with a squeezing motion, and the operator can easily gauge the amount of pressure, while, when necessary, the head of the machine can be pushed aside and ordinary hand-ramming resorted to. The lift is steady, true and parallel, and not only raises the mould off the pattern, but the moulding-box off the table pins. The machine is arranged to work with loose patterns, single or reversible pat-

tern plates, stripping plates, or stools, and with or without vibrators (mechanical or compressed air). It is claimed that any casting, however intricate, that can be moulded on any other known machine (providing it is not too large to go on the table), can be moulded by the "Coventry," and also that its depth of ram and height of lift are greater than in any other machine. There were two machines in operation at the Exhibition, one using a stripping plate and the other a vibrator, and they certainly appeared to do their work very efficiently.

Messrs. L. Sterne & Company, Limited, had a representative exhibit. Grinding wheels and machinery are a speciality of this Company. They make three different classes of wheels, the method of manufacture differing in each case. The "Consolidated" emery wheels can be run either dry or with water, which makes them particularly suitable for all kinds of tool grinding, sharpening saws, spindle and flyer grinding, fettling and trimming castings, as well as all sorts of general grinding. The "Silicate" grinding wheels are specially useful where very keen cutting wheels are required, and for grinding metals that have a tendency to make other wheels become glazed. The "Compound" emery wheels are suitable for certain kinds of special work. The Company also make a variety of machines of suitable design for mounting the wheels.

Messrs. Wadkin & Company exhibited a new patent mechanical woodworker for pattern and core-box work, which, it is claimed, will carry out the most intricate operations with accuracy, rapidity, and economy. The main frame is a strong solid cored casting. The rocking head or overhanging arm carrying the spindle head rocks vertically on sensitive bearings and can be depressed to a low angle below the level of the table. It has an exceptionally long overreach, well clear of the main frame, and the spindle head swivels from the vertical to a horizontal position. The cutter spindle has a reversing motion, and can be worked in any angular position between the vertical and horizontal. In addition, it is free to slide independently of any movement of the head, and is fitted with a quick-acting positive adjustment, and a slow screw adjustment. A registering scale is fitted to this slide with screw adjustment, giving the depth of cut. The swivelling motion is also provided with a graduated scale for setting to any desired angle of cut. The table mounting is a heavy cored casting, free to move bodily upon its foundation frame on runners actuated by a hand wheel. It can be instantly moved across the front of the machine from under the cutter spindle and away sideways, clear altogether of the machine head, in which latter position the spindle head can be lowered under the level of the table top. In addition to the lateral movement of the table body, the table is provided with a longitudinal and cross motion. The striking gear is actuated from either side of the machine head, and all clamps and other actuating handles are fixed upon the machine head within easy and ready access of the operator. Another exhibit at the stand was a new cutter vice, applicable to a wide range of work.

Messrs. J. Sagar & Company's exhibits included examples of their pattern-making machinery. Two kinds of lathes specially designed for this class of work were shown, one with headstocks 8 in. centres on 8 ft. bed, having a compound slide rest, and the other with headstocks 10 in. centres on 10 ft. sliding bed. The stand also comprised a "Premier" hand and roller-feed surface planing, thicknessing, and moulding machine. This machine is specially adapted for pattern-shop work, and is suitable for planing out of twist, surfacing straight or taper work, making glue joints, bevelling, squaring-up, light mouldings, rebating without change of cutters, thicknessing panels, boards, etc., from $\frac{1}{16}$ in. to 9 in. thick. It has also an appliance for giving the "strip" or taper required in engineers' and machinists' pattern-work. Dimension sawing and variety machines for ripping, cross-cutting, and mitreing, and a disc sand-papering machine were among the other exhibits.

Mr. William Herbert Perkins exhibited woodworkers' benches, vices, and other pattern-shop equipment. The bench shown was 7 ft. long by 2 ft. 6 in. wide, fitted with two vices of improved type, 9 in. by 4½ in., jaws to open 12 in. The front vice had a swivel jaw, with a screw adjustment for any taper or wedge-shaped work; the tail end vice had circular grip for cylindrical and semi-circular work. These attachments can be instantly fixed or removed, and fit any Perkins' vice of this type. The back standard was shown fitted with a vertical and horizontal slide for supporting heavy work in conjunction with the front vice, and for long-edge planing.

THE CONSOLIDATED PNEUMATIC TOOL COMPANY, LIMITED, made an effective display, including many tools for foundry purposes. The Company showed various sizes of their pneumatic sand rammer for ramming moulds, the "Ratcliffe" tube scaler, an improved pipe-cutting and threading machine, and a large number of different types of drills, including the "Boyer," "Keller," "Little Giant," and "Whitelaw" drills for drilling in metal, tube expanding and cutting, reaming, tapping, etc. The well-known "Boyer" and "Keller" hammers, for caulking, chipping, and riveting, were also in evidence, and there was an air-compressor and receiver plant, driven by an electric motor, and provided with all hose pipes, connections, and accessories necessary for showing the several classes of machines under working conditions. Altogether, the stand of this Company was of a very interesting character and attracted much attention.

MESSRS. MARKT & COMPANY'S stand was illustrative of the Corundum grinding wheels and other products of the Pike Manufacturing Company (U.S.A.), for which the former Company are the European agents. It is claimed that Corundum is the hardest and sharpest mineral available for abrasive purposes. It is undoubtedly possessed of great toughness, and breaks with sharp, jagged edges, thus having great durability and cutting power. The wheels are made in three classes. The "vitrified" process is used for products intended to withstand the effects of water, heat, oil, and acid; the "silicate" process is employed in wheels for certain kinds of wet tool grinding and for extremely heavy rough work; and the "elastic" in producing thin wheels used for smooth-surfacing hard steel, etc., and which can be run in caustic soda.

MESSRS. ESTLER BROTHERS showed storage bins for bolts, nuts, castings, etc. The bins are ingeniously contrived to economise space, and have many obvious advantages. They consist of sheet-iron troughs or buckets, flat at the back and sloping upwards in front. The vertical partitions to which these are fixed are also sheet-iron. A nest of iron bins is extremely compact, as the material is barely $\frac{1}{16}$ in. thick, whereas wood bins are as a rule at least 1 in. thick. Further, it is possible to practically fill the bins without the risk of the contents rolling out.

BRITISH FOUNDRYMEN'S ASSOCIATION.

Birmingham Branch.

THE Autumn Session of the Birmingham Branch of the British Foundrymen's Association was inaugurated on Saturday, October 26, at the Technical School, Birmingham, when the President of the Branch, Mr. R. Buchanan, delivered his presidential address. Mr. A. H. Hiorns presided over a large attendance.

Mr. Buchanan's address was substantially the one delivered to the South Staffordshire Iron and Steel Institute, of which he is also President, but some additional features were introduced.

Mr. Buchanan drew special attention to a letter which had appeared in the FOUNDRY TRADE JOURNAL, signed "J.P.," the writer of which was understood to be Mr. Roxburgh, of Kilmarnock. The writer referred to a paper read at the Convention by Mr. Sherburn. In relation to the appointment of Admiralty inspectors he pointed out that practical founders had no hope of appointment to the staff and he suggested that the conditions should be so altered as to make them eligible. He (Mr. Buchanan) thought that quite a legitimate request. It was right and proper that men used to the business should be introduced, and that the position should not be left in the hands of the privileged classes who hardly knew whether a casting was good or bad. The speaker recalled the fact that a defective rudder, which had already passed the inspectors, had been found on a warship which was about to go to sea. It had been actually "doctored," and if it had escaped notice it might have caused the drowning of the whole crew. That was an extreme case, but it illustrated the fact that most men held their fate in their hands, and there generally came a supreme moment which made or marred their fate for life. He decided for himself many years ago that he would never stoop to any devious course, and he should advise them always to keep clear of shady practices, which would never pay, either in this world or in the next. (Applause.)

The CHAIRMAN, in a short address, described Mr. Buchanan's address as highly intellectual and instructive, and he was specially impressed with its high moral tone. The speaker proceeded to instance a number of ancient ideas which had led the way to modern practice, so that present-day workers were only

building upon ancient foundations. The wedge-shape adopted for all cutting implements in the Stone Age was a good example. There was no doubt that inventions had been invented over and over again, and that the ancient workers were extremely skilful with the rude tools at their disposal. Although Dud Dudley died in poverty, his history demonstrated that there was no such thing as failure.

Referring to present-day practice, the speaker suggested whether the cupola was not both out of date and wasteful, and he thought it quite possible that the blast furnace owners might some day devise a scheme for running their products into one immense reservoir from which iron could be taken and used instead of being cooled down.

Mr. R. Mason proposed a vote of thanks to the President, whom he described as one of the greatest assets the Society had got.

Mr. F. J. Cook seconded, and referred to the question of apprentices, which he said was a matter of great importance. No doubt, the practice of "binding" them had finally gone out, but they should try to arrange to give boys their full term of training. The misfortune was that somehow the trade did not attract the most intellectual boy who had done well at school. As a rule, they could only get the boy who had not done well, and very often this meant that his deficient general education had to be supplemented. He had personally been in communication with the Technical School, to see if something could be done in the way of general education for the apprentices. But, unfortunately, his efforts had not succeeded. Professor Sexton had tackled the problem very successfully in Glasgow, and possibly Mr. Hiorns might render somewhat similar service.

The vote was carried with great heartiness.

Mr. Buchanan, acknowledging it, said that the preparation of the address had been a great delight to him, and especially to come into touch with such original characters as Dud Dudley and Cast Iron Wilkinson. Dudley felt very bitterly his treatment, and on one occasion he complained that they treated him like a wild beast.

Referring to Mr. Hiorns' remark, the speaker said that there was no doubt that the recent growth of casting direct from the blast furnace was an extension of ancient practice. There was a great future before it, but it would not be successful until a good mixer was adopted. There was no reason why it should not be carried out in works suitably situated, and the economy would be enormous. But at present there was a great prejudice against direct casting on the part of the people who did the inspecting, and it was quite likely that the prejudices were well founded. Results were sometimes indifferent, but a proper method of mixing should overcome all the drawbacks. With regard to the question of apprentices, a lad had a fine opening in a foundry. The well-educated boy was a good acquisition, and there was lots of room at the top. But it was a big order to introduce general education into technical schools. The great necessity was to raise the standard in elementary schools. England was suffering from the fact that she was behind Scotland in education at least one hundred years—one great authority put it at 200, but, at all events, the technical schools could not make up the great leeway which had been lost in the elementary schools.

Some formal business was afterwards transacted.

——o——

Messrs. Wm. Kenyon & Sons, Chapel Field Works, Dukinfield, near Manchester, have converted their business into a private limited concern.

The Engineering Standards Committee have issued report No. 35, British Standard Specification for Copper Alloy Bars for use in Automatic Machines.

Several "Secret Charge Weighing Machines" have recently been despatched to Rhodesia, different parts of Australia and Spain, by W. & T. Avery, Limited, Soho Foundry, Birmingham.

Mr. I. V. Robinson has been appointed London representative of Richardsons, Westgarth & Company, Limited, whose offices are at 5, Queen Anne's Gate, Westminster, S.W.

Messrs. F. Stacey & Company, of Winchester House, Birmingham, have been appointed sole agents for Allen's patent frictionless pistons, piston-valves, etc., for Scotland, and the Northern and Midland Counties of England.

Arthur Ross, Hotchkiss & Company, Limited.—Capital £10,000, to take over the engineering business of A. Ross, senior, 1, Glengall Road, Old Kent Road, and Bianca Road, Peckham, S.E. Registered office: 1, Glengall Road, Old Kent Road, S.E.

TRADE TALK.

Mr. T. Hill, ironfounder, of Hanley, Staffs., has been adjudged bankrupt.

The British Wagon Company, Limited, have just completed new works at Port Tennant.

Messrs. J. Lawson and F. Stobbart, engineers, Darlington, have dissolved partnership.

The Crown Brass and Engineering Company, of Bolton, are relinquishing their business.

Mr. J. South, ironfounder, Burnley, has removed to the Rake Head Iron Works, Burnley.

John Brown & Company, Limited, of Sheffield, have started the manufacture of chain cables.

The Hopkinson Engineering Company, of Leeds, have removed their offices to Huddersfield.

The dismantlement of the Beaver Iron Works, Horsley Fields, Wolverhampton, is now practically completed.

Messrs. James Lawson & Company, Cardiff, have removed to larger premises at 4, Church Street, Cardiff.

Mr. B. Rees has established himself in business as an engineer at Albert Chambers, High Street, Cardiff.

The Glacier Anti-Friction Metal Company, Limited, have moved from 91 to 112A, Queen Victoria Street, London, E.C.

Messrs. Bolton, Fane & Company have ceased to act as London agents for Pickerings, Limited, of Stockton-on-Tees.

Mr. J. A. Smeeton has been appointed London managing director to the Fusion-Welded Metals, Limited, 56, Victoria Street, S.W.

Messrs. F. W. Smith & Company, electrical engineers, have removed to 12, Tib Lane, Cross Street, Salford, Manchester.

Sir W. G. Armstrong, Whitworth & Company, Limited, have secured a site in Melbourne, N.S.W., for new shipbuilding works.

The Adams Manufacturing Company, Limited, have appointed Mr. C. H. Holgate, School Close Works, Leeds, as their Yorkshire district agent.

It is stated that an English company has purchased a site at Lachine, near Montreal, Canada, for the purpose of erecting locomotive works.

A dissolution of partnership is notified in connection with Messrs. R. T. Hogg and A. Mason, iron and brass founders, Union Foundry, Deptford, S.E.

The Frictionless Engine Packing Company, Limited, Hendham Vale Works, Harpurhey, Manchester, have changed the style of the firm to Small & Parkes, Limited.

Messrs. Congdon & Company, 5, Newton Street, Manchester, have been appointed agents for Lancashire and Cheshire for the Union Electric Company, Limited.

Messrs. W. Kirkham & Sons, furnace engineers, have opened branch works at Glover Street, Birmingham, and offices at Clarence Chambers, 39, Corporation Street, Birmingham.

Messrs. G. E. Byers & Company, Temple Bar House, Fleet Street, London, E.C., have secured the London export agency of Messrs. W. N. Brunton & Son, Musselburgh, N.B.

Messrs. Durham, Churchill & Company, of Sheffield, have appointed Messrs. Woodhead Brothers, Water Lane, Leeds, as their sole agents in the Leeds and East Yorkshire district.

The Humboldt Engineering Works Company have taken larger offices at Dixon House, Lloyd's Avenue, London, E.C., which they have put under the direction of Mr. Hugh Mackay.

Messrs. Gibbons, Skinner & Company, 12, Fenchurch Street, London, E.C., have been appointed sole agents for John Summers & Sons, Limited, Stalybridge, for London and the South Coast.

Messrs. T. Harding Churton & Company, Atlas Works, Leeds, have appointed Mr. C. A. Esmarch, 17, Collingwood Street, Newcastle-on-Tyne, to be their agent in Newcastle and district.

Messrs. T. Andrews & Company, Royds Iron and Steel Works, Sheffield, have appointed Messrs. J. Blachford & Sons, 90, Cannon Street, London, E.C., as their agents in London and district.

Messrs. A. P. Wright & Company, 60, Queen Victoria Street, E.C., are now London district and shipping agents for Messrs. Belliss & Morcom's patent high-speed self-lubricating paraffin oil engines.

A meeting of the Union Rolling Stock Company, which went into voluntary liquidation some years ago, has been held, to receive the report and accounts of the liquidator. The Company has been dissolved.

HEAD, WRIGHTSON & COMPANY, LIMITED, have offered during the month an issue of 21,000 6 per cent. cumulative preference shares of £5 each at par, being the balance of a total authorised issue of 42,000 cumulative preference shares.

THE following deed of arrangement is notified:—W. Brooks, trading as W. Brooks & Sons, Britannia Engineering Works, Harts Hill, Brierley Hill. Unsecured liabilities, £328; estimated net assets, £145; secured creditors, £642 3s. 1d.

MR. T. WALKER, connected with Messrs. J. Parkinson & Son, engineers, Shipley, and Mr. H. Walker, connected with Messrs. Newton, Bean & Mitchell, engineers, Dudley Hill, have established themselves in business at the Samson Iron Works, Bradford.

THE STORA KOPPARBERGS BERGSLAGS COMPANY, a concern represented in Great Britain by the Stora Kopparbergs Bergslags Aktiebolag Agency, Limited, 6, Laurence Pountney Hill, London, E.C., have acquired the Söderfors Iron Works in the centre of Sweden.

THERE are at present three new works in course of erection in Lancashire. One is being built by H. R. Kearns & Company, Limited, of Broadheath; the second at Failsworth by the Hele-Shaw Friction Clutch Company; and a third by Mr. John Swallow, of "The Grange," Sutton Oak, near St. Helens.

ITALIAN capitalists have now entirely absorbed the shipyard and engineering plants hitherto worked in Italy by Armstrongs. A company has been formed called the "Societa Anonima Napoletana Armstrong of Pozzuoli," with a capital of 2,000,000 lire, which will take over the Armstrong Company of Pozzuoli.

JULIAN KENNEDY, SAHLIN & COMPANY, LIMITED, have secured a contract for the design, inspection, and engineering of a complete plant for the manufacture of coke, pig-iron, steel, and rolled products, as well as for foundry and mechanical shops, from the Tata Iron and Steel Company, Limited, British India.

THE horse-power of the turbines constructed by the Parsons Marine Steam Turbine Company, Limited, during the last financial year was 79,600, and there are orders now in hand of 27,800 h.p. The Company's licencees during the same period constructed turbines of 309,000 h.p., and they have orders in hand amounting to 463,800 h.p.

NEW COMPANIES.

COSLETT ANTI-RUST SYNDICATE, LIMITED.—Capital £10,000, in £1 shares.

R. G. KYTE & BANKS, LIMITED.—Capital £2,000, to carry on the business of engineers, ironfounders, etc.

JONES & HUNT, LIMITED.—Capital £2,000, to acquire the business of the Bradley Bridge Iron Foundry.

J. & C. HOLCROFT, LIMITED.—Capital £50,000, to acquire the Portfield Iron Works, Dudley Port, Tipton.

W. P. EGLIN, LIMITED.—Capital £25,000, to acquire the Sowerby Bridge Globe Works, belonging to Mr. W. P. Eglin.

THE HOLM FORGE COMPANY (BELLSHILL), LIMITED.—Capital £5,000. Registered office: 190, St. Vincent Street, Glasgow.

ROPNER & SONS, LIMITED.—Capital £150,000, to acquire the business of shipbuilders carried on at Stockton, as Ropner & Son.

WRIGHT & WOOD, LIMITED.—Capital £12,000, to carry on the business of manufacturing electrical and mechanical engineers, etc.

SPENCER, JACKSON, LIMITED.—Capital £1,000, to carry on the business of engineers, etc. Registered office: 41, Holborn Viaduct, E.C.

FLOTTMANN ENGINEERING COMPANY, LIMITED.—Capital £3,600, to take over the business carried on at 36, Park Place, Cardiff, as the Flottmann Engineering Company.

J. HARRISON CARTER, LIMITED.—Capital £25,000, to take over the engineering business carried on at Dunstable and at 82, Mark Lane, E.C., as J. Harrison Carter.

RIGNOLD'S ADJUSTABLE CARBURETTER COMPANY, LIMITED.—Capital £1,000, to take over the business carried on at 27, Roscoe Street, Liverpool, as Rignold & Benyon.

STAHLWERKS VERBAND'S BRITISH AGENCY, LIMITED.—Capital £10,000, to carry on business as noted elsewhere. Registered office: 13-14, Abchurch Lane, E.C.

H. R. JONES, WILSON & COMPANY, LIMITED.—Capital £1,500, to take over the engineering business of H. R. Jones,

Wilson & Company, 28, Chapel Street, Liverpool.

WILLIAM BYWATER, LIMITED.—Capital £10,000, to acquire the business of W. G. Bywater, Sweet Street Foundry, Leeds. Registered office: 6, Kidson Street, Holbeck, Leeds.

TONGE & TAGGART, LIMITED.—Capital £6,000, to acquire the business of Tonge & Taggart, engineers, ironfounders, etc., Dublin. Registered office: 10, Windmill Lane, Dublin.

JAMES HOWDEN & COMPANY, LIMITED.—Capital £200,000, in £10 shares, to take over the business of James Howden & Company, engineers, Glasgow. Registered offices: 195, Scotland Street, Glasgow.

WM. TOWLER & COMPANY, LIMITED.—Capital £40,000, to take over the ironfounding business carried on at the Globe Foundry, Holbeck, and the Assembly Works, Leeds, as William Towler.

ROBERT WARNER & COMPANY (ENGINEERS), LIMITED.—Capital £18,000, to acquire the business carried on at Walton-on-the-Naze, Essex, and 97, Queen Victoria Street, E.C., as Robert Warner & Company, and to carry on the business of ironfounders, etc.

—o—

DEATHS.

MR. H. JONES, ironfounder, Queen Street, Neath, at the age of 82.

MR. J. LEWIS, of Messrs. John Lewis & Sons, engineers, Point Law, Aberdeen.

MR. J. KINCAID, senior partner in the firm of Messrs. Kincaid, Waller, Manville & Dawson.

MR. J. WILKES, founder, and, until recently, proprietor, of the Pelsall Foundry, aged 82.

MR. T. KEETMAN, founder of the Duisberg Engineering Works, formerly known as Bechem & Keetman.

MR. J. S. MARSLAND, managing director of Drakes, Limited, of the Ovenden Works, at the age of 45 years.

MR. W. HOLMES, Barrow representative of the Wigan Coal and Iron Company, Limited, at the age of 56 years.

MR. H. PAWSON, a director of Grayson Lowood & Company, Limited, John Round & Company, Limited, etc., aged 87.

M. VINCENZO SPIREK, the eminent metallurgist, who invented the furnace that bears his name, at the age of 55 years.

MR. E. YATES, a director of the well-known firm of Smith & McLean, Limited, Gartcosh and Mavisbank Works, Glasgow, aged 71 years.

MR. S. LEES, head of Messrs. H. Lees & Sons, Park Bridge Iron Works, and Bridge End Works, Ashton-under-Lyne, aged 76 years.

MR. G. A. MILLWARD, who was connected with the Shelton Iron and Steel Company, Stoke-on-Trent, at the age of 53 years.

MR. E. T. WRIGHT, who, with his brother, managed the business for the trustees of the late Mr. G. B. Wright, engineer, Millfields, Bilston, aged 29 years.

MR. G. HALL, an ex-Master Cutler of Sheffield, and head of the firm of G. & J. Hall, Hereford Street, Sheffield, steel and engineers' tool manufacturers, in his sixty-eighth year.

MR. D. CARLAW, Sen., one of the best-known engineers in Glasgow. Mr. Carlaw, who was in his seventy-fifth year, was the head of the firm of Messrs. David Carlaw & Sons.

MR. J. C. WARNE, a director of W. Roberts & Company, Limited, Crown Copper Mills, Garston, who was also connected with Messrs. John Bibby, Sons & Company, Garston Copper Works, aged 71 years.

MR. R. A. SORBY, at his residence, Thorpe Salvin, near Worksop, at the age of 54 years. He was a son of the late Mr. T. A. Sorby, J.P., of Park Grange, Sheffield, and of the well-known firm of Robert Sorby & Sons, edge tool manufacturers.

MR. R. WALKER, of the firm of Messrs. Walker Brothers, Wigan, Limited. The deceased, who was about 33 years of age, resided at Southport, being constantly in touch with the business at Wigan, which he represented in Scotland and the North of England generally, as well as in the Midlands.

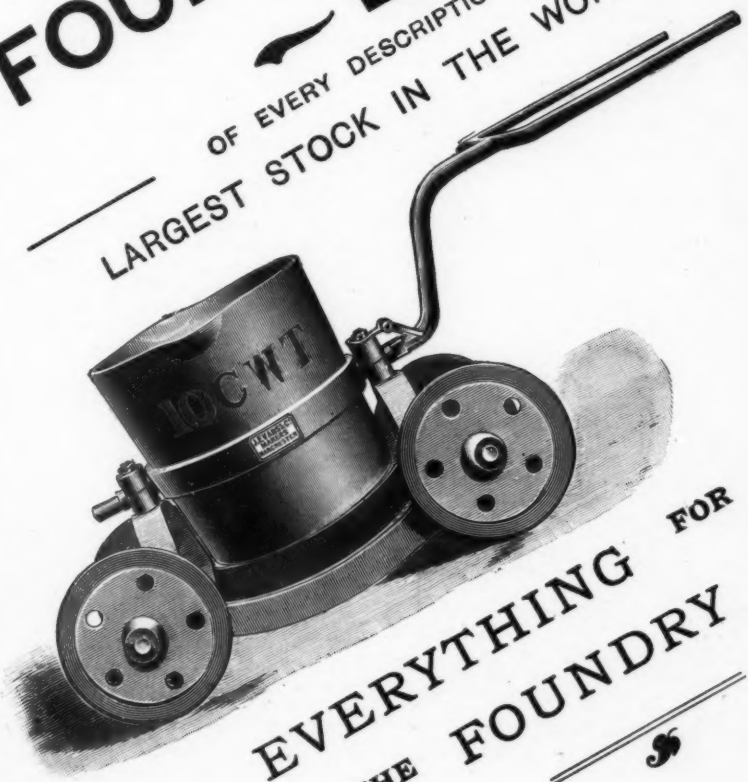
MR. G. SOMERVILLE, senior partner in the firm of Messrs. Somerville & Crombie, Gilmore Park Engine Works, Edinburgh. Mr. Somerville, who was born at West Calder more than 70 years ago, spent some portion of his early engineering life in English workshops, and went from Carlisle to Edinburgh, where he joined the Fountainbridge firm, which he conducted with skill and intelligence for many years.

Contractors to H.M. Government.

FOUNDRY LADLES

OF EVERY DESCRIPTION.

LARGEST STOCK IN THE WORLD.



EVERYTHING FOR THE FOUNDRY

JAMES EVANS & CO.,

Telegrams:
"LADLES, MANCHESTER."
"BLACKINGS, GLASGOW."

BRITANNIA WORKS, MANCHESTER.

PERSONAL.

THE gross value of the estate of the late Mr. J. Waddington, ironfounder, etc., is £5,589.

SIR HUGH BELL, BART., has decided to resign his membership of the Middlesbrough Corporation.

SIR JOHN DURSTON, who has been Engineer-in-Chief of the Navy for over 18 years, has retired.

THE estate left by the late Mr. Charles Akrill, ironfounder, of Edgbaston, has been valued at £66,835.

THE late Mr. H. Arnold, chairman of the Hodbarrow Iron Company, left estate valued at £59,342 gross.

MR. H. BEDFORD, the 284th Master Cutler of Sheffield, has been formally installed during the month.

MR. R. GREENHALGH, of Greenhalgh & Company, Limited, engineers, Atherton, Bolton, has been made a J.P. for the borough.

MR. T. COOK, of Messrs. Spencer & Cook, Empire Engineering Works, Stalybridge, has been elected a local Town Councillor.

THE late Mr. W. Brock, head of Messrs. Wm. Denny & Bros., Dumbarton, left personal estate of the value of £168,504.

MR. A. CATTELL has been appointed managing director, and Mr. J. H. Baker general manager, of Moses Eadon & Sons, Limited, of Sheffield.

MR. ANNETT, secretary, and Mr. O. G. Manson, assistant secretary, of the Liverpool Engineering Society, are relinquishing their appointments.

MR. S. W. BROWN, of Swinney Bros., Limited, Wansbeck Iron Works, Morpeth, has been elected an Alderman of the Morpeth Town Council.

MR. H. WALLIS has retired from the position of managing director of the Birmingham Small Arms Company, Limited, but retains his seat on the board.

THE late Mr. E. Gearing, managing director, and lately general manager and a director of the Leeds Forge Company, Limited, left estate valued at £20,253 gross.

THE gross value of the estate of the late Sir John D. Milburn, Bart., chairman of the Hebburn Boiler Company, Limited, and a former chairman of Palmers' Shipbuilding and Iron Company, is £391,339, of which the net personalty has been sworn at £318,360.

MR. T. W. SHEFFIELD, the North of England representative of Messrs. Crompton & Company, has been appointed the British agent of Messrs. Wassermann & Company, Lausanne, Switzerland, whose speciality is a new process for braising cast iron called "Castolin."

—o—

ALTENBACH, LIMITED, have lately started business at the Helvetia Steel Works, Brighouse, as manufacturers of castings in malleable iron, steel alloys, and special steels, and are making a speciality of mild-steel castings for breakdowns.

THERMIT, LIMITED, have opened at 210A. Bow Road, E., a fully-equipped repair shop, where they are prepared to carry out repairs by means of their alumino thermic welding process. Estimates for work and illustrated pamphlet will be forwarded free of charge upon application to the Company, 27, Martin's Lane, Cannon Street, E.C.

Ganister, Cupola Blocks, Fire Bricks,
Fire Clay.
Silica Bricks, Tuyeres, Stoppers, Nozzles, &c.
Steel Moulders' Composition, Silica Cement.

J. GRAYSON LOWOOD & Co., Ltd.,
DEEPCAR, nr. SHEFFIELD.
Telegrams: "LOWOOD, DEEPCAR."

PATENT

ALUMINO THERMIC WELDING PROCESS

REG. TRADE MARK.

— FOR —

BROKEN CASTINGS.

REPAIR SHOP

NOW OPEN.

ESTIMATES for WORK and ILLUSTRATED PAMPHLET upon application to

THERMIT LIMITED,

27, MARTIN'S LANE, CANNON STREET, E.C.

ELDERS FOUNDRY COKE

As supplied to the British . . Admiralty Dockyards.

The following, selected from numerous letters, are eminent testimony as to the quality of our celebrated "A.A.A." Coppee Foundry Coke, carefully selected, and despatched in sheeted wagons.

From PECKETT & SONS, Bristol.

Bristol, October 25th, 1904.

We have been using your Selected Foundry Coke for some considerable time.

We have pleasure in stating that we are very pleased with it, as we find we get sounder and cleaner castings, more free from blow-holes and other defects, than we formerly did.

From MOUNTFORT PHILLIPS & Co., Llantrissant.

Llantrissant, October 25th, 1904.

In reference to the Foundry Coke you have been supplying us with for the last six months, we have very great pleasure in letting you know that it has given every satisfaction, and that our Works Manager and Workmen give it the highest praise.

Elders Navigation Collieries, LTD. Cardiff.

PRICES OF METALS.

The following table shows the approximate latest prices and position of stocks of metals during the past two years :—

METALS.	1906-7.	1905-6.
Iron—Scotch pig warrants ... ton	*63/6	*62/0
—Middlesbro' warrants ... ... ton	51/11	57/9½
—W.C. M/nos Bessemer ... ... ton	73/0	70/0
—Stock, Scotch, October 31 ... tons	1,300	10,030
Copper—Chili bars, GMB ... ... ton	£65 12/6	£97 2/6
—Stock, Europe & afloat... ... tons	10,683	12,896
Tin—English ingots ton	£149 10/0	£193 0/0
—Straits ... ton	£147 5/0	£192 15/0
—Stock, Ldn. Hlnd and afloat ... tons	11,324	11,778
Lead—English pig ton	£18 15/0	£19 15/0
Spelter—Ord. Silesian ... ... ton	£22 0/0	£27 15/0
Quicksilver-(75lb.) bottle	£8 4/6	£7 0/0
Antimony—Regulus ... ... ton	£42-£45	£107 10/0

*Settlement price.

CASTINGS.

In the Cleveland district the following are the nominal rates current for castings :—

	£ s. d.		£ s. d.
Columns (plain)	7 0 0	to	7 5 0
Pipes, 1¼ to 2½ in.	5 10 0	to	5 15 0
,, 3 to 4 in....	5 2 6	to	5 10 0
,, 5 to 8 in.	5 0 0	to	5 2 6
,, 10 to 16 in....	5 0 0	to	5 2 6
,, 18 to 24 in....	5 0 0	to	5 2 6
Chairs	4 2 6	to	4 5 0
Floor plates (open sand)	3 5 0	to	3 10 0

SCRAP.

The quotations for scrap, subject to market fluctuations, are as follows:—Heavy wrought (mixed), £2 14s. 0d.; light wrought, £1 12s. 6d.; heavy cast, £2 9s. 0d.; all per ton f.o.b., London. Copper (clean), £58; brass (clean), £42 10s. 0d.; lead (usual draft), £17 10s. 0d.; tea lead, £15 15s.; zinc, £17 10s. 0d.; all per ton delivered merchant's yard.

SILICA FIRE BRICK Co.,

OUGHTIBRIDGE.

GROUND GANISTER,

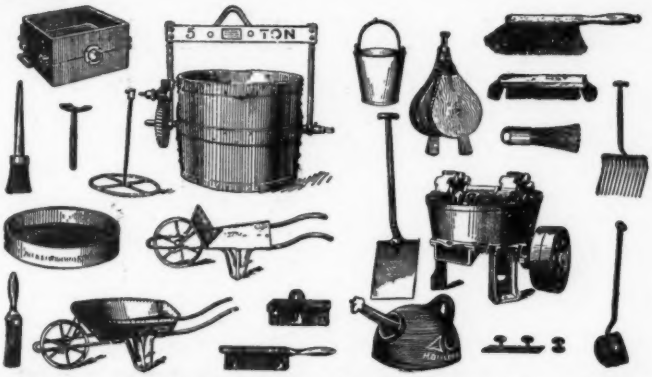
Wet or Dry.

Silco Cupola Bricks, 90 % Silica.

Better than Fire-clay Bricks for Cupolas.

Established 1863.

Jas. Durrans & Sons,



PHŒNIX WORKS, PENISTONE, Near Sheffield.

Manufacturers of all

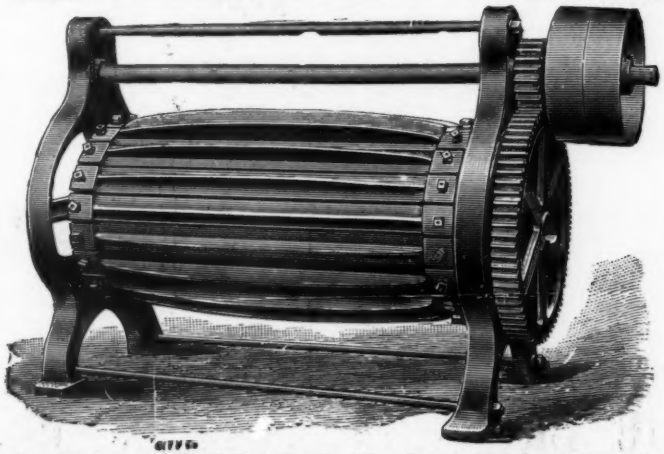
FOUNDRY EQUIPMENTS,

Composition Black Lead,

Plumbago, Core Gum, White Dust, and Coal Dust.

Ladles, Cupolas, Fire Bricks, Gannister, Stone Flux, Loam and Sand Mills, Casting Cleaners, Studs, Chaplets, Pipe Nails, Sprigs, Brushes, Wire Brushes, Core Ropes, Bellows, Buckets, Spades, Forks, Riddles, Sieves, Barrows, &c.

IMPROVED FOUNDRY RATTLER or FETTLING DRUM.



These Machines are invaluable for a Foundry, doing a larger amount of work of a superior quality, in a much shorter time than can be done by hand, without skilled labour.

"Dear Sirs,—We have been using your best Blacking for a large number of years, and always use it on our large Ingot Moulds, which, as you know, we have made up to 85 tons in weight.

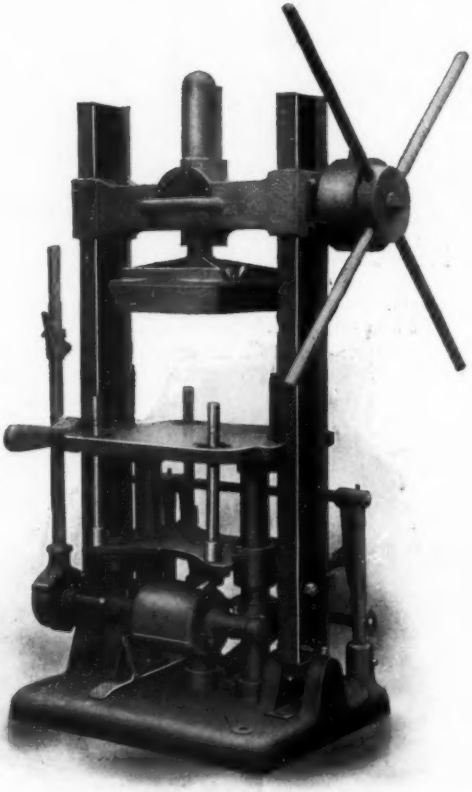
"Yours faithfully, THE BRIGHTSIDE FOUNDRY & ENGINEERING CO., LD."

THE "COVENTRY"

MOULDING MACHINE.

(By Royal Letters Patent.)

A Power Machine



without Power.

MADE BY

THE BRITANNIA FOUNDRY CO.,

COVENTRY, England.

SITUATIONS VACANT.

WANTED, a MANAGER for an old established Steel and Iron Foundry and Engineering Works. Applicants must be prepared to take up an interest in the concern. —Apply Box 640, Offices of THE FOUNDRY TRADE JOURNAL, 165, Strand, London, W.C.

PATTERN FILER for Foundry Wanted immediately; one used to moulding machine; state age, wages required, and references.—Address Box 644, Offices of THE FOUNDRY TRADE JOURNAL, 165, Strand, London, W.C.

WANTED, good DRAUGHTSMAN for Woodworking Machinery; state age, experience, and wages required.—Address Box 645, Offices of THE FOUNDRY TRADE JOURNAL, 165, Strand, London, W.C.

WANTED, a first-class MANAGER, to take sole charge of White Glazed Brick Works, to be started abroad; state age and experience, with references, which will be kept strictly confidential.—Apply Box 646, Offices of THE FOUNDRY TRADE JOURNAL, 165, Strand, London, W.C.

FOR SALE AND WANTED.

ROOTS' BLOWER, No. 6, 17 in. outlet, and Duplex Engine combined, by Thwaites, condition equal to new.—EDWARD WRIGHT, Engineers' Tool Merchant, Gordon Street, Bradford.

FOR SALE, PATENT PRESSURE BLOWERS FOR CUPOLAS:—

No. 1a size "Allday's" 6 in. outlet, as new.
„ 5a „ "Thwaite's" 4 in. „ „
„ 2 „ „ 8 in. „
„ 13 „ "Baker's" 11½ in. „

Air Compressor Belt, Driven, for Pneumatic Tools, Sand Blasting, Moulding Machines, etc. Size 8½ in. by 7½ in., about 55 ft. free air per minute.

Address: J. LIGHT, Hope Cottage, Dunstall Road, Wolverhampton.

FOUNDRIES, one within 30 miles of London and the other in Scotland, with extensive and substantial Buildings, partly equipped with Plant, to be SOLD by PRIVATE TREATY.—For details and terms apply to FULLER, HORSEY, SONS & CASSELL, 11, Billiter Square, E.C.

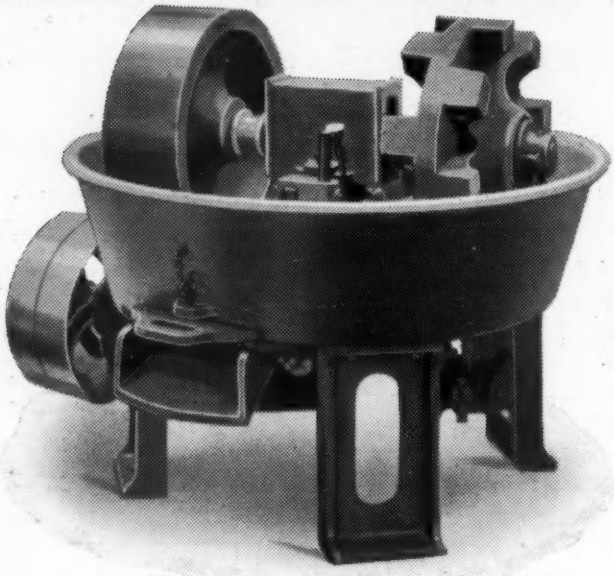
BAND Re-Saw, 2 by 6 in.; Four-cutter Planing and Moulding Machine, by Robinson; can be seen working; 6 ft. by 3 ft. Circular Saw Bench; 36 in. by 20 in. Box Printing Machine; Hand Morticing Machine, by Haigh; Trapping Machine; cheap.—SOUTHERN, Store Street Saw Mills, Manchester.

SITES FOR WORKS.—To be LET, on Lease, in South Staffordshire district, excellent Works Sites, with canal and rail communication. Three-penny canal toll only on fuel.—J. H. BULLOCK, Estate Agent, Walsall.

FOR SALE, FOUNDRY, up to date, with house, plant, shops and tools complete. Owner retiring.—Address BREHAUT, St. Sampsons, Guernsey.

SEVEN by 3 High-speed MOULDING MACHINE, by Kirchner, three rates of feed, with measuring attachment; cost £105; done one week's work; absolutely new; f.o.r., with belts and pulley, £80; seen working.—A. TILNEY, The Western Valleys Steam Joinery Works, Abertillery, Mon.

J. W. & C. J. PHILLIPS,
23, COLLEGE HILL,
Cannon Street, LONDON, E.C.,
Publish a Special Catalogue devoted to
MODERN FOUNDRY EQUIPMENT.
This Catalogue describes the Best of Everything for the Foundry, and is in fact the first British Catalogue of its kind.



DEEP PAN SAND AND LOAM MILL.

Sand Preparing Machinery of all Types.

PATENT CORE MAKING MACHINE for Irregular Cores.

Output 10 times greater than hand labour. Perfect Cores.

Our Hydraulic Multiple Moulding Machine

SAVES LABOUR.

Increases Production. Reduces Working Expenses.

Saves Moulding Boxes and Floor Space.

Over 60 of these Machines at work in one Foundry.

WRITE US FOR FULL PARTICULARS AND PRICES.

MOULDING MACHINES. SAND BLASTS. CORE OVENS.

THE LONDON EMERY WORKS Co.,

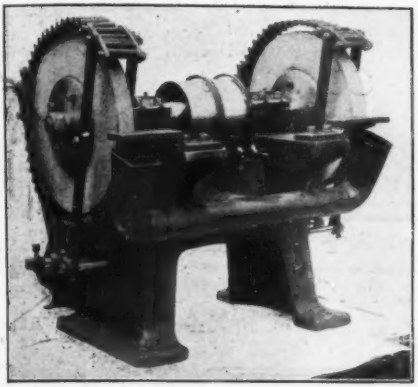
Park, Tottenham, LONDON, N.

Telephone No. 47 Heaton Moor.

MANUFACTURERS OF

Telegraphic Address: "Heroic, Reddish."

Crystal Canadian Corundum,



CARBO CORUNDUM

AND

EMERY WHEELS,

For Foundry Use

ALSO

ALL CLASSES OF

GRINDING . . MACHINES. . .

Send for Catalogue and Prices.

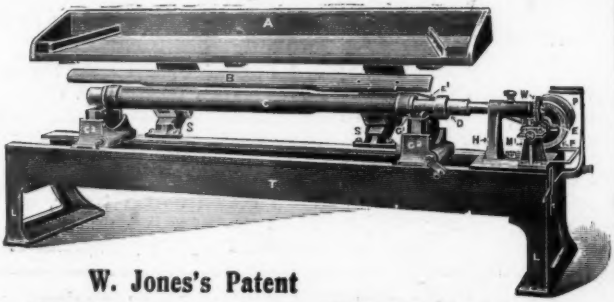
B. R. ROWLAND & CO., LTD.,

REDDISH, Near STOCKPORT.

A REVOLUTION IN

Pipe Foundry Practice

For Pipe Cores, 18 ft. long and 2 in. to 20 in. diameter.



W. Jones's Patent

CORE FORMING MACHINE

JONES & ATTWOOD,

STOURBRIDGE, ENGLAND.

"CHARLIER" MELTING FURNACES

(USING CRUDE OIL).

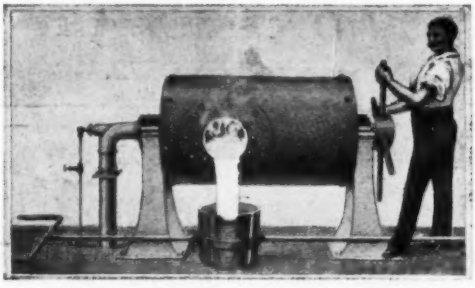
THE MOST WONDERFUL INVENTION OF THE AGE FOR MELTING.
6 CWT. IN 35 MINUTES

GUNMETAL, BRASS, MANGANESE, PHOSPHOR BRONZE, ALUMINIUM, IRON, ETC.

SAVING 50% TO 70% IN YOUR MELTING BILL.

IMPORTANT POINTS :

NO CRUCIBLES. — NO COKE. — NO ASHES. — LESS FIREMEN.



Adopted by all up-to-date Foundries in the United Kingdom.

1,000 in use in America.
200 in use in France.
65 in use in Paris alone.

NOTE! The General Founder who melts a great variety of Metals in the course of a day may think the Charlier Furnace will not accommodate itself to the conditions ruling in his shop. But such is emphatically not the case. The point overlooked is that the Furnace is quite Six times as Rapid as a Coke Fire, therefore from a No. 2 Furnace quite Four Heats of 100 can be run in one hour, say over 30 in a day, allowing ample time to clean out after each charge. Demonstrations by Appointment.

COMPLETE INSTALLATIONS ERECTED BY

BENNETT & SON,

CONTRACTORS TO H.M. GOVERNMENT,

42, Trinity Square, Tower Hill, LONDON, E.C.

Telegrams—
"Tuyere, Manchester."

ON ADMIRALTY LIST.

National Telephone—
No. 70, Openshaw.

T. DAVIES & SON,

Railway Ironworks,

WEST GORTON, MANCHESTER.

ESTABLISHED 1876.

Makers of Complete Foundry Plant. Cupolas of all Types.
Charging Platforms. Hand and Crane Ladles.

DROP BOTTOM CUPOLA.

SOLID BOTTOM CUPOLA.

A

FIRST CLASS PATTERN PLATES

are now being made by moulders in foundries, with

WHITE'S PATTERN PLATE APPARATUS

without the aid of any expensive machine tools.

No method of making repetition work in foundries **is complete without** a simple ready system of making pattern plates as required for either hand or machine moulding.

White's system completely meets these requirements. Write for illustrated pamphlet, to

EDW. WHITE, Windsor Works, Redditch.

ON ADMIRALTY LIST. London Office: W. Littleton, 9, Fenchurch Street, E.C.

SOLE MAKERS of **"PEHRSON'S PATENT STEEL MOULDERS' GREENSAND."**

GROUND GANNISTER, STEEL MOULDERS' COMPOSITIONS, SILICA CEMENT.

GANNISTER BRICKS, FIRE BRICKS, STOPPERS and NOZZLES. CRUCIBLE CLAY for ALL PURPOSES.

J. & J. DYSON, Sheffield Gannister Works, ATTERCLIFFE ROAD, SHEFFIELD.

Telegrams—"DYSON'S, STANNINGTON." Telephone—No 702 SHEFFIELD.

CHAS. HALL,

Foundry Requisite Maker,

DANTZIC ST., MANCHESTER.

STEEL WIRE BRUSHES.

Chaplets and Studs a Speciality.

COLD BLAST PIG-IRON.

M. & W. GRAZEBROOK, DUDLEY.

STOURBRIDGE FIRE BRICKS

OF BEST QUALITY FOR LINING CUPOLAS

— IN STOCK, ALSO MADE TO ANY DESIGN. —

Linings Stocked to Customers' Plans to ensure IMMEDIATE DELIVERY.
All kinds of Fireclay Goods of highest quality.

HARRIS & PEARSON, STOURBRIDGE.

Telegrams: "Fireclay, Stourbridge." Telephone: No. 7 Brierley Hill.

GENERAL FOUNDRY PRACTICE.—A Practical Handbook for Iron, Steel, and Brass Founder, Metallurgists, and Students of Metallurgy. By A. McWILLIAM, A.R.S.M., and PERCY LONGMUIR. Cloth. Fully Illustrated. 15s. net.
"Contains a tremendous amount of information. *Engineering Times.*

LECTURES ON IRONFOUNDING.—By THOS. TURNER, M.Sc., A.R.S.M., F.I.C. In extra Crown 8vo. With 48 Illustrations. 3s. 6d. net.
"Ironfounders will find much information in the book.' *Iron Trades' Circular (Rylands).*

THE METALLURGY OF IRON.—By THOMAS TURNER, M.Sc., A.R.S.M., F.I.C. In large 8vo. Cloth. Very fully Illustrated. Third edition. Ready very shortly.
"A thoroughly useful book, which brings the subject up to date. . . . Of great value."—*Mining Journal.*

THE METALLURGY OF STEEL.—By F. W. HARBORD, A.R.S.M., F.I.C., with section on the Mechanical Treatment of Steel, by J. W. HALL, A.M., Inst. C.E. Third Edition, Revised. With 37 Plates, and 300 Illustrations in the text. 25s. net.
"An invaluable compendium of information." *Iron and Coal Trades' Review.*

ELEMENTARY METALLURGY.—A Text-book of. By A. HUMBOLDT SEXTON, F.I.C., F.C.S. Fourth Edition, Revised. With numerous Illustrations. 6s.
"Just the kind of work for Students commencing Metallurgy or for Engineering Students." *Practical Engineer.*

MICROSCOPIC ANALYSIS OF METALS.—By FLORIS OSMOND and J. E. STEAD, F.R.S., F.I.C. Beautifully Illustrated with nearly 100 Photomicrographs. 7s. 6d. net.
"A useful contribution to Metallurgical literature." *Chemical News.*

LONDON: CHARLES GRIFFIN & CO., LTD. EXETER STREET, STRAND.

Contractors to the Admiralty and on India and War Office Lists.

THE CONSOLIDATED PNEUMATIC TOOL CO., LTD.

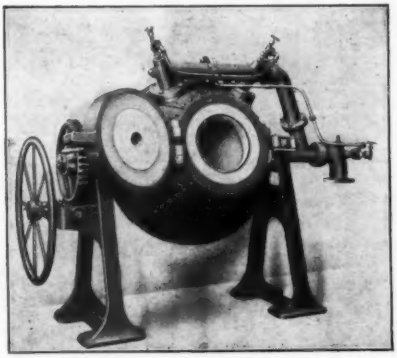
THE SCHWARTZ FURNACE

will be found of great service in Foundries for melting

BRASS, COPPER, BRONZE,

and all kinds of Metal.

Made in sizes from 100 to 10,000 lbs. per heat.



The Schwartz Metal Melting and Refining Furnace.

MANUFACTURERS OF THE

BOYER, KELLER, LITTLE GIANT, AND **WHITELAW HAMMERS and DRILLS.**

AIR COMPRESSORS and all Accessories.

COMPLETE PLANTS supplied under One Guarantee.

General Offices—

PALACE CHAMBERS, 9, BRIDGE STREET, WESTMINSTER, S.W.

Workshops and Showrooms within a few minutes' walk of the Offices, where **PNEUMATIC** and **ELECTRIC** Tools can be seen in Operation. Inspection Invited.

Telegraphic Address: "Caulking, London." Telephone Nos.: 2052 and 3987, Gerrard.

CUPOLA LININGS of "Black Delph" Firebricks

combine great refractoriness with high resistance to abrasion.

E. J. & J. PEARSON, Ltd., STOURBRIDGE.

FOUNDRY REQUISITES.

BRUSHES, BELLOWS, BUCKETS, BARROWS, BLACKING, COAL DUST.

CHAPLETS & STUDS, CEMENT, CORE GUM, CORE ROPE, CORE TAPER, CRUCIBLES, CUPOLAS,

LADLES, RIDDLES & SIEVES, SPADES, SPRIGS, TERRA FLAKE, FERRO-ALUMINIUM, ETC.

MOOR & SONS, 1, Fennel St., MANCHESTER, (Dept. F.)

Established 1857. Telegrams "Acklam." Telephone, No. 3566.

FIRE BRICKS & CLAY

CUPOLA BRICKS.

BEST QUALITY.

Lessees of Delph and Tintern Abbey Black and White Clay.

KING BROTHERS, STOURBRIDGE.

J. W. & C. J. PHILLIPS,

23, COLLEGE HILL, Cannon Street, LONDON, E.C.,

Publish a Special Catalogue devoted to

MODERN FOUNDRY EQUIPMENT.

This Catalogue describes the Best of Everything for the Foundry, and is in fact the first British Catalogue of its kind.

ELASTENE CORING ROPES

Are superior to Hay or Straw Bands and are now extensively used in . .

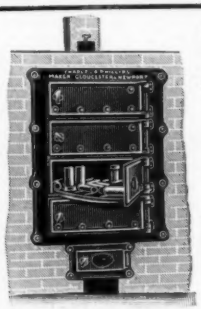
ALL LEADING FOUNDRIES.

Sole Makers—

CITY of LONDON WOOD-WOOL Co.,

Contractors to H.M. Government,

Plover Street, London, N.E.



Charles D. PHILLIPS'

Registered and Improved No 356,812

FOUNDRY CORE OVEN

built in wall.

Head Office—

Emlyn Works, Newport, Mon.,

(and Gloucester).

ESTABLISHED 39 YEARS

ON ADMIRALTY, WAR OFFICE, AND INDIA OFFICE LISTS.

As the result of experiments over a number of years, we are now preparing to put on the Market an **IDEAL** composition

= BLACKING =

FOR **SPECIAL ENGINEERING CASTINGS** TO ANY WEIGHT.

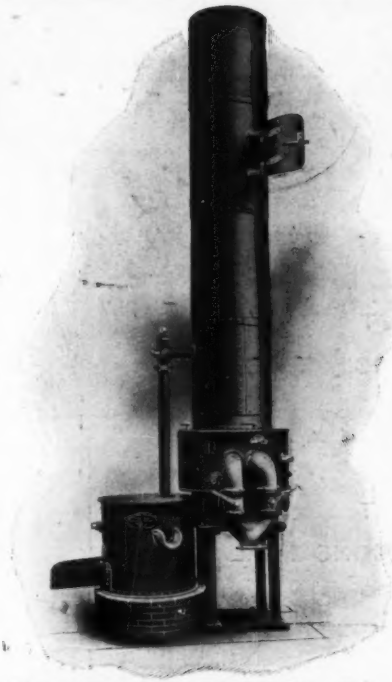
Price £6 per Ton d/d 2 Ton loads and upwards. Extra for smaller quantity.

Uniformity of quality guaranteed. No need for Plumbago.

SEND FOR FREE SAMPLE.

THOMAS WILKINSON & CO., Ld., Middlesbrough.

FOUNDRY PLANT.



Cupolas,
with or without receivers or drop bottoms.

Roots' Blowers,
belt, steam-engine, or electro-motor driven.

Charging Platforms, Hoists, and Ladles.

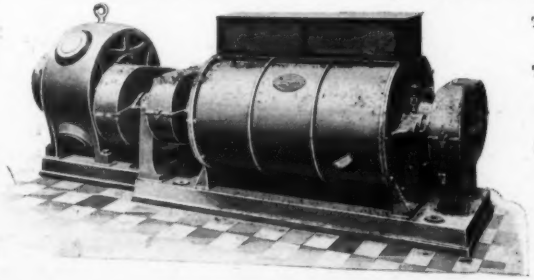
ECONOMICAL RESULTS GUARANTEED.

We are also Manufacturers of Steam Hammers, Smiths' Hearths, Centrifugal Pumps and Fans, High-Speed Engines, and the "Bradford" Patent Boiler Feed Pump.

CONTRACTORS TO HIS MAJESTY'S GOVERNMENT.

THWAITES BROS., LTD.,

Vulcan Ironworks, BRADFORD.



Telegrams —
"THWAITES, BRADFORD."

Telephone:—
No. 325 BRADFORD.

London Office—
96 & 98, Leadenhall Street, E.C.

CATALOGUES ON APPLICATION.

Evans' Rapid Cupolas.

ON ADMIRALTY LIST.

ON WAR OFFICE LIST.

MOST SCIENTIFIC.

MOST ECONOMICAL.

BEST IN THE MARKET.

Highest melting efficiency.

NONE SO GOOD AS EVANS' RAPID.

Ask for Estimates and Copy Testimonials.

OVER 400 IN USE.

Telegrams: "LADLES, MANCHESTER."

Telephone: 2297 Nat., Manchester.

JAMES EVANS & CO.,

Britannia Works, Manchester.